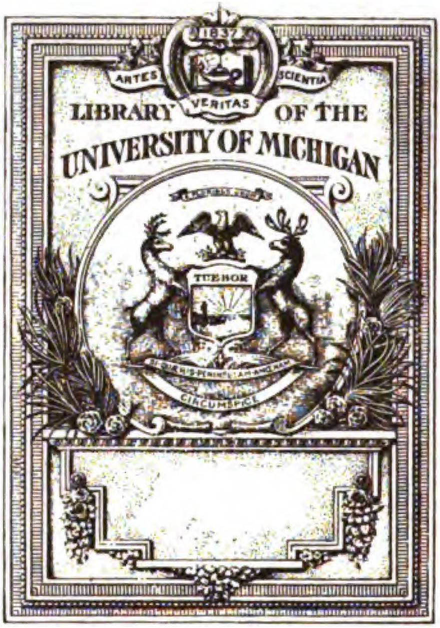
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STATE OF NEW YORK

State college of agriculture, Ithaca

Thirty-first Annual Report

of the

New York State College of Agriculture at Cornell University

and of the

Agricultural Experiment Station

Established under the Direction
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CORNELL RURAL SCHOOL LEAFLET

PUBLISHED BY THE DEPARTMENT OF RURAL EDUCATION, NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

VOLUME XI ITHACA, NEW YORK, SEPTEMBER, 1917 NUMBER 1

THIS ISSUE IS FOR TEACHERS

SUBJECT MATTER FOR 1917-1918 IN NATURAL HISTORY, AGRICULTURE, AND HOME MAKING, BASED ON THE NEW YORK STATE SYLLABUS FOR ELEMENTARY SCHOOLS

Entered at the post office at Ithaca, New York, as second-class mail matter

Cornell Rural School Leaflet

PUBLISHED BY THE DEPARTMENT OF RURAL EDUCATION OF THE NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY, ITHACA, NEW YORK

ALBERT R. MANN, DEAN OF THE COLLEGE
GEORGE A. WORKS, HEAD OF THE DEPARTMENT

Then let us go forth to the forest shades
Where creep the cool winds o'er the freshened ground
And health reigns like a Queen.

* * * * * * *

Here let me draw a lesson from the woods
And from the deep stillness; for my mind is full
Of the calm teachings of these tranquil hours.
Ye who would lift your souls above the earth,
And revel in the unutterable Thoughts
Rushing from the wild mysteries of Time,
Th' abode of the great secrets of the world,
Go to the still forest, with a calm, strong heart,
And stand amid the murmuring of winds,
The tinkling of the waters and the spell
Of the high Presence.

Here I bend and feel
The littleness of my strong hopes. If ye
Would know how weak our false desires—how tame
The highest aim of all, save those who strive
By good deeds to come near the Throne of Good—
How like a maniac's daring seems the strife
For eminence, by overturning Truth
And the unbending law of virtue—stand
In the full calm and quiet of these woods
Till the iron visor from your soul falls off,
And you hear the true teachings which of old
Gladdened your spirit, ere you stifled Peace
With trappings from the armory of the world.

From *The Forest*
by H. HUBBARD

THE SALUTATION OF THE DAWN

Listen to the Exhortation of the Dawn!
Look to this Day! For it is Life,
The very Life of Life.
In its brief course lie all the Varieties
And Realities of your Existence;
The Bliss of Growth,
The Glory of Action,
The Splendor of Beauty:
For Yesterday is but a Dream,
And To-morrow is only a Vision;
But To-day well lived
Makes every Yesterday a Dream of Happiness
And every To-morrow a Vision of Hope.
Look well therefore to this Day!
Such is the Salutation of the Dawn.

From the Sanskrit

CORNELL RURAL SCHOOL LEAFLET

VOLUME XI ITHACA, NEW YORK, SEPTEMBER, 1917 NUMBER 1

FOREWORD

We have to keep each other spirited.

ALICE GERTRUDE McCLOSKEY

Never before has there been so much need that we who teach little children should keep our courage and our faith — faith in the fundamental influence that education exerts on the life of the individual, of the nation, and of humanity; courage to build steadily and quietly and well, in the midst of chaos.

In a time when the immediate future demands such a large proportion of the thoughts and energies of men and women, there must be some who are ready to do the less spectacular but the no less important work of preparing for a more distant time when the world will begin to rebuild what has been destroyed, and to unite the races of men in bonds of common interest and humanity.

The work of a true teacher is always constructive. The habits and ideals that persons acquire in childhood determine, to a large extent, their attitude all through life. It is no exaggeration to say that the future of the world rests in the hands of its teachers in schools and in homes, and if the day ever comes when we put one-half the money into education that to-day we are putting into destruction, wars will cease. True education must be founded on ideals no less than on facts, on character no less than on intellect.

A mother asked not long since what she should teach her little children about war. She did not believe in war, but she realized that there have been times, like the present, when a country must take up arms. In such a case her son should not be found among those who shrink from duty. Yet she felt that there must be some way to make wars in the future impossible. Is not the answer to this mother's question to be found in an attitude to life and to mankind? Suppose that we could teach our boys and girls two things, until they became fixed in character and thought and action. The first of these is unselfishness, a readiness to think of the interests of others before one's own, an unwillingness to gain at the expense of a fellow being. This presupposes the ability to earn an honest living — skill, thrift, and the power to stand on one's own feet. The second is charity in its truest sense, a universal benevolence and good will, a liberal and kind attitude in judging men and their actions. Even though we may never reach the place where all men are ready to love one another,

surely we should soon come to the point where no man will hate another in bitterness and vindictiveness. If our boys and girls grow up unselfish and charitable, wars of lust and of aggression will be impossible, and should some other people less advanced on the road to humanity seek gain at the expense of mankind, then our act of punishment and correction will be tempered with mercy and understanding.

It is our privilege and our responsibility as teachers to give service of untold influence. There should be no self-consciousness nor hypocrisy in our attitude. We must carry the work of each day as heretofore, only with greater earnestness, greater willingness, greater faith in its worth. We realize that in the past we have not always been ready to give our utmost strength of body, mind, and spirit to the boys and girls. Sometimes it has been hard to keep the vision, and our work has seemed more a job, with a salary and certain requirements of time and action attached, than anything else. Such an outlook makes teaching drudgery to us, and learning lifeless to the children. During the coming year let us earnestly resolve that we will be true to the best that is in us; that we will keep our spirit, our vision, our cheerfulness; that we will strive to be unselfish, tolerant, patient, and just; that we will make our teaching real, and vital, and true, bounded by human sympathy and application; that we will study each child to find the way to help him or her to a wholesome, capable manhood or womanhood, and to "a realization of the abundance of life."

We shall not attain and maintain such an attitude without a struggle. Human nature is prone to make mistakes and to backslide. Yet half the battle is to recognize when we fail, and to take a new hold. "Every minute we must exercise the will," and, hard though it may seem, we cannot let down even for a minute without losing something of our power to guide little children rightly. Those who have thus lived and taught know how rich is the reward, and those who have not as yet sensed the wonder and been ready to pay the price, have now an added incentive to make the effort. It should be a great year of building that will bear fruit richly ten, twenty, thirty years ahead when there will be need. There is no greater service than to labor on the foundations, out of sight, often in the dark, with little to inspire except an inner light. Many will use the foundations later, seldom realizing how they came to be there. But we know, and that they are there, strong, and true, and ready, is our reward.

This number of the Cornell Rural School Leaflet will be found to resemble those of past years. There has been no need to change, for the work has always been based on fundamental considerations. This does not mean that we do not grow; on the contrary, new suggestions come

constantly, both from within the institution and from the schools. The growth is, however, one of progress along a road already made clear by the vision which we owe largely to Miss Alice Gertrude McCloskey, who founded the work and who built so well during her lifetime. We have reached the place where little effort is needed to point out the road and to prove the wisdom of traveling that way. The power and the value resulting from the use of the environment and of the experiences of life in the education of children, are universally recognized. It remains to help those teachers who are on the road, to travel with the greatest ease and profit to themselves and to the children they guide.

Onee we have the vision and the desire to start, we need the aid of accurate and true knowledge. The articles on the following pages have been prepared by specialists. Teachers should regard this material as designed to give them a background from which to guide the activities of the boys and girls. Suggestions for using the technical knowledge are contained, to some extent, in the articles themselves, but more largely in the notes introducing the various sections. Subject matter should rarely be passed on as such to the children. The leaflet should, in no sense, be considered a textbook. It is a book of reference and suggestion. It indicates to teachers what may be learned about any given topic, and ways in which boys and girls may be led to gain the knowledge by first-hand observation and experience. The work should be real, earnest, honest, and full of human interest. Particular emphasis is laid on the importance of reading the more general articles that give point of view and setting for the technical material.

In closing this foreword, the editor wishes to express to teachers the deepest appreciation of the spirit, and the courage, and the devotion with which the teaching of little children is carried on in this State, and his readiness to contribute to the work of any individual or group, if it lies within his power to do so. It is our privilege, as well as our responsibility, to have some share in giving to the world strong, wholesome, capable, resourceful, balanced, and spirited young men and women.

THE POINT OF VIEW

Teaching must be a true art work. It is the turning of little souls to life.

ALICE GERTRUDE McCLOSKEY

THIS is the most important section of the leaflet, and it will bear constant rereading. Its value lies in the fact that it presents the actual testimony of teachers who have been pioneers in the work in nature study. Any of the other material could be dispensed with more readily than these extracts from teachers' letters, which should serve to give to all teachers new vision and new courage in the work.

It has been difficult to select material to publish from the wealth of experience related in the letters from the teachers who responded so promptly and so generously to a request for a statement of their attitude and success in the work. Much attempt at classification has been out of the question, but it may be remembered that this article contains two divisions, one concerning the work in schools under rural supervision, the other concerning the work in villages and cities having superintendents of schools of their own. However, there are no hard and fast lines of difference, as will be seen by reading the letters. The urban point of view has been emphasized because need has been felt for it by the many teachers in the larger centers of population who now use the leaflet. It will also be found that many of the most pertinent experiences of a more specific nature have been incorporated in various places throughout the leaflet into the notes introducing the different main divisions of the work as indicated by the State Syllabus. This is particularly true of the work in home making.

There still may be heard with more or less insistence a demand on the part of some that the work be more definitely outlined. Teachers have become so accustomed to having everything put into their hands ready for use, that many have lost the power to stand on their own feet and to think creatively. There are tremendous danger and untold dreariness in such a procedure. Life is worth living only when we vibrate in unison with it, and more than with any other group of persons this should be true of those who teach little children. The material in this leaflet should furnish ample background for a beginning in any of the lines of work. Intelligent reading will reveal countless suggestions and methods of approach. It is expected that teachers will select those that fit their conditions both as regards the materials available and the ages and

aptitudes of the pupils; in other words, that teachers will plan their own work. And, in fact, unless this is done, the results will hardly be worth the effort.

One cannot read the letters that follow without having a feeling that something of great worth is going on in many schools, for the twenty or more quoted are typical of hundreds in all parts of the State. Some persons will continue to maintain that there is too little definiteness, that the work is not systematic enough. The chances are that it is much more systematically planned in the individual schools than appears on the

EDUCATION THROUGH ACTIVITY THAT RELATES TO LIFE
District 11, Town of Seneca, Ontario County

surface. In the sense that there is no fixed plan for all schools, that no definite amount of time or stated hours are stipulated, that no one best way of teaching each topic is advocated, that the widest measure of freedom and the exercise of judgment are left to the teacher — in this sense there is little definiteness. Broad and fundamental principles of scope, procedure, and results to be expected are everywhere emphasized. The results speak for themselves to one who can read between the lines. There are clearly revealed a spontaneity, a life, a zest, an earnestness, a happiness, and a voluntary pursuit of true knowledge, that are epoch making in school-teaching. The schools are growing human; they are touching reality in all its phases — practical, æsthetic, spiritual.

Of course nature study is not the only avenue through which growth of interest and resource as well as of technical knowledge, is coming to children. The free use of good literature, of good music, of art materials, of simple dramatics, and of the folk dancing and play that characterize the activities of physical training — all these have the same elements of quality, reality, and human interest that belong to nature study. We are building rounded lives, and, far from neglecting the more formal and customary school subjects in the process, are providing a way to make them mean more to the children. It is the universal testimony of teachers who have quickened their pupils through some human resource, that the children respond more effectively to the acquisition of all knowledge, even that which necessitates a large amount of practice and routine drill.

We are particularly concerned in this leaflet with nature study, and certain it is that the possibilities in it are infinite. Our best definition of nature study is that it is the use of the environment in education. As such it may be interpreted to include many phases, but more especially the three that relate to the out-of-door world (natural history), to the use economically of the forces of nature (agriculture), and to the activities of our lives in families (home making). It may not be out of place to say a few words once again on each of them.

Natural history is the study of the out-of-doors. It forms the background of country life and is a resource in all life, and every boy and girl should be encouraged to find education in the world of nature. They should know the wild life about them — the birds, the trees, the flowers, the weeds, the insects, the animals of field and wood. They should take an interest in the soils, the rocks, the brooks, the hills, the woodlot, the forest. They should learn to love the music of the wind, the soughing of the pines, the clear starlight, the restfulness of rains, and the magic of the snows. All persons should learn the wholesome resource of the out-of-doors.

Agriculture is a dignified industry based on natural laws that govern the production and reproduction of crops and animals. For its greatest development it must be founded on a scientific knowledge of these laws. Boys and girls in the elementary grades should be taught to seek the truth in all that has to do with farm experiences and practices, and to turn to authorities for information that relates to farm problems. They should know who are the investigators in the many phases of scientific agriculture in state and national institutions and why they have a right to receive help from these persons. The authors of the technical articles in this leaflet are scientific investigators for the State of New York with whom the children may become acquainted.

Home making is an occupation that affects every person, young and old. Science is constantly bringing new knowledge regarding the importance of diet, clothing, personal hygiene, sanitation, and household management. Boys and girls should be taught to recognize these factors in their lives and to take an intelligent attitude toward them.

It is impossible to comment on all the important points that the following letters present. They must speak for themselves. In general it is clear that the nature study work permeates the whole life of the school; that while a fixed period is desirable at times to summarize what has been done and to plan ahead, the time to study any given topic is when the occasion arises naturally; that all activity should be related to actual material, and that the pupil should study, investigate, and work for himself; that books should be used as guides and references, but never as texts in the usual sense of the word; that much value may be derived from wisely planned trips afield and to neighboring farms and industries; that the economic and general interest phases merge into each other and that the one most emphasized depends on conditions and the age of the pupils; that the community becomes interested and a bond is established between school and home; and that the whole attitude of boys and girls to life and to work is deepened and made richer, and sweeter, and happier, and of greater service in all ways.

ANIMAL LIFE MAY BE KEPT IN THE SCHOOLROOM FOR A DAY AND STUDIED FIRST-HAND

Grateful acknowledgment is made to the following teachers under rural supervision who sent letters relating their experiences, from among which the extracts quoted were taken. Teachers who aided last year were not called on again, though a few wrote of their own accord, and the material was too valuable to omit. This will explain an occasional duplication and the reason why the others do not appear again. Beyond question they would have had much of value to contribute, but it was felt desirable to give others a chance. The list is, in a very real sense, a roll of honor.

Eunice G. Appleton, Watkins, Schuyler County
Grace E. Austin, South Glens Falls, Saratoga County
Annie B. Buckley, Goldsmith, Franklin County
Mary Bullard, Sterlingville, Jefferson County
Anna Cavanaugh, Ballston Spa, Saratoga County
Mrs. Virginia Wade Clark, Harpursville, Broome County
Vera E. Cotter, Union Springs, Cayuga County
Avis Countryman, Poland, Herkimer County
Viola Culver, Trumansburg, Tompkins County
Anna E. Driscoll, Whitney Point, Broome County
Marjorie Dunham, Alpine, Schuyler County
Anna Edwards, Fultonville, Montgomery County
Rebecca L. Elliott, Triangle, Broome County
Clara Faecke, Angelica, Allegany County
Edna V. Fowler, Antwerp, Jefferson County
Barbara R. Hall, Argyle, Washington County
Jessie E. Hays, Bristol, Ontario County
Helen L. Heath, South Glens Falls, Saratoga County
Florence Hinckley, Delhi, Delaware County
Doris E. Hodgin, Glenville, R. F. D. 2, Warren County
Myrtia M. Howes, South Wales, Erie County
Anna B. Howley, Port Leyden, Lewis County
E. Louise Hoyt, Dundee, Yates County
Flora Huntington, Ithaca, R. F. D. 3, Tompkins County
Eva Huntley, South Otselic, Chenango County
Mrs. C. B. Keller, Little Falls, Herkimer County
Anna Leavenworth, Willowemoc, Sullivan County
Hilda Lillibridge, Blossvale, Oneida County
Gertrude L. Lonas, Glenfield, Lewis County
Clara A. Martin, Pierrepont Manor, Jefferson County
Mrs. Ida Mitchell, Ithaca, R. F. D. 7, Tompkins County
E. C. Neiger, Kenoza Lake, Sullivan County
Elizabeth Nesbitt, Whitehall, Washington County
Bessie M. Parker, Adams Center, Jefferson County
Walter D. Parker, Honeoye, Ontario County
Grace E. Petteys, Greenwich, Washington County
Grace Pierce, Carthage, R. F. D. 5, Jefferson County
Mary Rock, Wiscoy, Allegany County
Orpha A. Ross, Hadley, Saratoga County

Louise Rossier, Canandaigua, Ontario County
Jennie Schofield, 15 Purdy Street, Bath, Steuben County
Lillian Searle, Savannah, Wayne County
Mary E. Smithling, Lyonsdale, Lewis County
Sarah Southard, Newark, Wayne County
Mrs. Eva Spaulding, Malone, Franklin County
Martha E. Steere, Guilford, Chenango County
Mrs. Izora Thompson, Pharsalia, Chenango County
Clara Tine, West Leyden, Lewis County
Lena Twiss, Claverack, Columbia County
Edwin J. Van Deusen, Canajoharie, Montgomery County
Katherine E. Wallace, Truxton, Cortland County
A. Mable Warner, Albion, Orleans County
Agnes M. White, Brasher Falls, St. Lawrence County
Tina May Wilcox, Smithville Flats, Chenango County
Lillian R. Williams, Perry, Wyoming County
Mrs. S. R. Wood, Wilmington, Essex County

LETTERS FROM TEACHERS UNDER RURAL SUPERVISION

I am glad that there are to be more extracts from teachers' letters in the leaflet. I received many inspirations and suggestions from last year's leaflet, and if any of my experiences will be of any use to others, I shall gladly pass them on.

Though a country girl, I knew very little about country life in detail. I knew a horse from a cow, a robin from a crow, and could recognize a few of the common flowers and weeds and trees. Perhaps you can imagine my first attempts at teaching nature study. I tried stated lessons in textbooks, outlines galore, keeping a watchful eye on the Syllabus in the meanwhile to see that I did not get the wrong ones or too many. The method was a flat failure. I could not get interested in the work when I made such a bugbear of it, and the children disliked it even more. Now I employ the conversational method almost entirely. Sometimes I correlate it with English and have stories and descriptions written about some of the things.

I use the syllabus as a general outline in order to know to what things to pay particular attention each year. The leaflet I use chiefly for my own information though I allow the children to use it for reference. Last fall I obtained a traveling library from the State. In this I ordered a good percentage of nature study books, which are used solely for reference. The children take them home almost as eagerly as they do the storybooks.

I have no definite way of bringing up a topic before the school. It seems to start itself from anything that comes up. I have a time for the class on my program, but we do not confine ourselves to that time nor keep the topics to ourselves until class time. Three of the children are going to have gardens this year, and the publications sent from the College furnish material for study and discussion. That does not seem so hard as studying a lesson in agriculture.

I have learned that the more we can find to do for nature study or any of the agricultural or home making pursuits, the better the work in the other subjects becomes. As yet the community has shown little interest in the work done by the school, for only one family in the district shows any interest in the school anyway. I think we can wake the rest up later after the work gets out of the pioneer stage a little more.

The one essential feature of our school curriculum is nature study, and in this I have had failures as well as success. I consider nature study the connecting link between school and home life.

To begin with, having never had any instruction in the subject except a few weeks in training class, I was seriously handicapped as to where to begin or what to do when

I began. We worried along for a few weeks studying leaves, weeds, flowers, and other forms of life that we found near us. And then the teachers' Cornell Rural School Leaflet arrived! I thought, " No more difficulties in teaching nature study with such a wealth of material! " But I soon found something lacking. Not nearly the interest was shown now in getting a lesson from a book as when we had a plant, a bunch of flowers, or real insects before us to study. The class was now lacking enthusiasm and vim, whereas before it was difficult to keep all from talking at once. I soon realized what the trouble was, and it is needless to say what I did. Now everything is studied from the object first-hand when it can be obtained, and although I think our Cornell Leaflet is more valuable to us now than before, we never study an object entirely from that.

My nature study class is held in the last fifteen minutes before noon, and the whole school is included. I found this subject difficult to grade, so all learn from one another and from Mother Nature all together. This class is usually a conversation period, but nature study is not confined entirely to this time, for we discuss a subject whenever it is brought up whether that be during recess or drawing class. If any one has anything to prepare before class it is usually I, but I also try to ask questions or suggest a topic that will lead the pupils to find out something for themselves before the next recitation.

We often take a trip afield. And where can nature be studied to better advantage? This need not be a hilarious expedition with nature farthest from the children's minds. If a little forethought and care be used by the teacher, it can prove most helpful.

One day last week I took the children at noon into a near-by sugar bush where the sugar makers were at work. The children were greatly interested in this. On a sunny

THE GREAT OUT-OF-DOORS IS A PART OF THE SCHOOL EQUIPMENT THAT SHOULD NOT BE OVERLOOKED

Children of District 15, Town of Massena, St. Lawrence County

knoll we found some hepaticas in bud. Three new birds were seen and added to our bird calendar. A water snake and a butterfly were also seen. We gathered some juniper branches with berries and some vines with partridge berries.

I am convinced that nature study is one of the greatest helps in discipline. Through nature study you have something with which to keep the pupils always busy, as there is always something more they wish to find out about, and this keeps them out of mischief. I believe in it because it has helped me to reach children when everything

else failed, because it acquaints them with nature, which every day presents some new and interesting fact.

I have no prescribed outline that I follow. I tried that and failed. I always use the object itself if possible. I try to arouse the pupils' interest so that they are anxious to learn more. We use textbooks only when unable to find out from nature herself. It makes the other work more interesting. In fact every lesson becomes a nature study lesson more or less.

IDENTIFYING SPECIMENS. A TYPE OF EXAMINATION THAT APPEALS TO CHILDREN
District 11, Town of Allegany, Cattaraugus County

The season guides me somewhat as to the right time to take up a subject. When some special interest has been manifested in anything, is a good time to take up that subject. Only experience has taught me the right way to present a subject. You must study conditions and the attitude of your pupils. Feel your way and proceed carefully or your efforts are lost. I have failed when I have required lessons studied from books.

One of the older pupils always reads Mr. Tuttle's letter aloud, and then it is talked over so as to be sure that we get his message. Then the letters from the boys and girls are read, and we try to find something helpful from their experiences. The rest of the work in the leaflet is read and talked over, and we make use of whatever meets our needs.

Nature study is making the girls and boys wide-awake to all they see out of doors. It teaches them kindness to animals and birds, makes them patient, persevering, and thorough. It has brought the community into closer touch with the school and has developed a willingness on the part of the parents to help the boys and girls to find and preserve specimens in their work. It is also waking up the community to the necessity of destroying the harmful and preserving the beneficial forms of life.

We use the leaflet as a reference book. I study certain parts before giving the lessons, and any time we find a weed, a seed, or in fact anything we do not know, we bring it to school and look it up if we can. Frequently I am asked, "Please may I take the leaflet home to mother? She wishes to look up something." The children often come early to school for this purpose. We also hunt out the birds in the *Birds of New York*, furnished by the State. There is a frequent request to take the *Birds of*

New York home because the parents, usually mothers, are interested in some bird that they have seen and want to know its name. Some of them have had feeding stations during the winter.

In my opinion there is no part of the school work of greater value than this to the community in general and the pupils in particular. It teaches children to observe, to be kind and gentle, self-reliant, helpful, and in fact is a good character builder. I should dislike giving it up.

The teacher who does not teach nature study loses a large share of good fun.

When I first began teaching, I thought that I had to adhere strictly to the syllabus and always have the nature study class at a certain time; but I soon changed this plan. I have found in rural communities intensely interested in this subject, that this class is continuous. I think that in the few years in which nature study has become a regular subject in the rural schools, the life of the farmer has been greatly elevated.

I am a great lover of nature myself, and I naturally delight in teaching little children to love her. I think that nature study has had and will have more to do in forming good, clean lives for the men and the women of to-morrow than any other subject ever taught in the common schools. It is also helping to solve the problem of keeping the boy on the farm. The farmer of the future will have a greater knowledge of the wonders of the great out-of-doors than his parents had. He will have time when plowing or doing other work on the farm to examine weeds, insects, birds, and other natural objects, and will stop to think whether or not they are injurious.

As to the right time to take up the topic — whenever specimens are brought in, is the time to discuss them. If a question is asked on some nature study or agricultural problem, it should be answered at once if possible. It should certainly not be shoved entirely aside. In this case the interest of questioner and listeners may be lost. In my school, if something is brought in with which we are not familiar, we search for all information we can find on the subject. All other school work is improved because of this. If called from their work to observe perhaps a bird feeding on some near-by tree, the children return to their other work with keener minds.

The leaflet is my guide. I use other books to supplement the material given in the leaflet, and especially for information on topics not given this particular year; but I find that it is best to use the leaflet as the main source. I plan my lessons so that I am perfectly familiar with the topic on hand. When I have planned to give a certain lesson, I usually see to it that this lesson comes when I can have specimens in the hands of the pupils. Collecting the specimens is the outgrowth of some pupils' interest, for I ask previously who can bring the insects or the plants or whatever we need.

I teach the lesson by asking questions and supplementing answers by explanation. Whenever we can, we find our answer from the specimen. On many succeeding days I ask who remembers that special plant or bird or insect and what they can tell about it. There is always great interest. I believe that the person who compels pupils to learn long descriptions of natural objects or who reads pages of uninteresting description to them, will not get interest, and that in this way the very object of this work, to encourage love of the out-of-doors, will be defeated.

We have a few minutes a day on our program for nature study, but we are a very busy school and do not find it possible to have this every day. We have two kinds of nature study lessons, the ones that come at the regular time with the specimens previously brought to the classroom, and those that come when we interrupt our program to learn about something of present interest.

One day just as we finished an English class, one of the boys saw several birds in the school yard. According to our custom the boy told me about the birds, and all the pupils passed quietly to the windows. There on the ground outside were eighteen slate-colored juncos. Many of my smaller pupils had never seen a junco so we had a splendid lesson. This spring four or five bluebirds came to the young trees near the school windows, and we took this occasion for a study of the bluebird, for we had been watching for the bluebird for two weeks. Among the things of interest in our school-

room just now are several branches of trees having egg clusters of the apple-tree tent caterpillar and several strange kinds of cocoons, all of which we are watching develop.
We have enjoyed all our school work very much, finding so much interest in all our nature work that it is not easy to tell what thing in nature had been most interesting. I wish to say for the benefit of teachers who may find this letter too optimistic that we have had the same hard work and routine and discouragements that come to other schools. I believe that a *little* well done will be an inspiration to both teacher and pupils. Any teacher who is not much interested in this work will find new interest and a new depth of vision to her own life if she will make ever so small a gift of whole-hearted time to it.

I have found that through the study of nature we become acquainted with the real child and at the same time form a bond of friendship between pupil, teacher, and parents, which is very essential.

MANY VALUABLE LESSONS CAN BE TAUGHT THROUGH RAISING A FLOCK OF POULTRY AT THE SCHOOL AND THROUGH SIMILAR ENTERPRISES

District 9, Town of Otsego, Otsego County

On the way to school and when we reach school, the children and I talk about the topics that they themselves have given me. I often direct them to books and ways of finding more about the topic under discussion; then we sometimes wait a couple of days so that they may look up facts before we take up the topic more fully again. Whenever it is possible, we learn from observation. The other day while talking about the robin, the question arose as to whether both birds or just the mother bird sat on the eggs. Some already knew, but those who did not are going to try to find out from observing the robin. In this same way we take up many topics.

The nature study work has gone forward with leaps and bounds since my summer of training. The children are very enthusiastic, and the farmers are waking up. There has been a marked indifference of the parents toward the schools in late years. I have tried hard to overcome this. We have had spelling matches, socials, evenings of song, entertainments, amateur theatricals, and many other things to bring parents to the school, or rather to bring them together, for most of our events were held in my home,

which has large rooms, while our schoolhouse is rather small. We have also had exhibition days, when the best work of the pupils was exhibited. At each occasion I took the opportunity to say a few things to interest the men and women. The parents certainly visit the school more. We had a community Christmas tree, and in spite of a terrific snowstorm our celebration was well attended. When parents, especially

A FAIR SERVES TO INTEREST THE COMMUNITY IN THE WORK OF THE SCHOOL

District 7, Town of Seneca Falls, Seneca County

men, have visited my school, I have taken pains to point out the need of certain articles of school equipment. Now we have a nice new stove, a stereoscope with one hundred and twenty-five views to aid in teaching geography, and several other improvements.

The people had an idea that nature study was all humbug, and were rather skeptical about it, last year especially. But when we began the study of rations and weeds, they changed their minds. I must tell you of an incident that happened this fall. We were in my father's meadow identifying weeds, and the children were writing about them in their tablets. An old gentleman drove along the road, stopped, and cried, "Hey, kids, where's your teacher?" I went down to see what he wanted, and he asked me what nonsense we were up to. I explained to him, and he said that I couldn't fool him, he knew very well that the kids didn't care about the weeds, but only waited till my back was turned to play with each other. Well my back *was* turned, but the children kept on with their work, and soon moved to another weed. We could hear their excited chorus of, "Here's some chickweed!" "What are you talking about! That's purslane!" and so on. The old gentleman was very much surprised, but said that he guessed that children had changed some since he was a boy. I don't think they have, do you?

(*Editor's note.*— This teacher took the summer school course at the State College of Agriculture on a scholarship founded by her fellow teachers. It is a praiseworthy movement, and one that should grow.)

I realize now that pupils will not learn nature study unless they are interested and have the object at hand or are acquainted with it in some way or other. I used to teach it as I did other lessons and at stated periods, but found that my pupils never

seemed to know anything about what I taught. Now I find that they usually know more than I do. Nature study does not become monotonous if it is varied by drawing and writing in place of talking.

Books used after the child has found out what he can by himself about the subject, prove more interesting to him and tell him many things to which he would pay little attention if read before. I do not think that we can give a lesson from a book on nature study and expect a child to remember as he would learn and remember from nature specimens, nor is it so broadening.

I have a rather large school for a district in the woods as this is — twenty-three pupils, and all but the eighth grade, in a small schoolroom. It means a great deal of work, and I almost never feel that I have accomplished what I should at the end of the day. It is very unsatisfactory in lots of ways to try to carry on the work of so many grades, though I sometimes think that a school seems more alive under those conditions and the children more interested. I had the same school last year, but we have made much more progress this year I think, because I know the children well. Then, too, this year I have let my older boys and girls help the younger ones, as monitors. They do more and more, it helps me a lot, and they like to do it. It seems to develop initiative. This is an example: We prepared a play and exercises for

THE RURAL SCHOOL SHOULD BE IN CLOSE TOUCH WITH THE STATE COLLEGE OF AGRICULTURE

Part of the rural school exhibition, Farmers' Week, 1917

Thanksgiving. We put quite a little time on it, and the children did very well indeed. It was held in the evening, and our schoolhouse was crowded, as everybody came. We had decided to just have a tree at Christmastime, but a few days beforehand one of my older girls asked if they could speak a few pieces if they would do the work themselves, as " it would seem more like Christmas." I gave my assent, and on Friday

afternoon I listened to their program, really in amazement. The two oldest girls had found something for each one to do and had drilled at noon and at recess. A jolly Santa Claus came in, and I enjoyed it especially, because I had not expected anything of the kind.

(*Editor's note.*— This teacher took the summer course at the State College of Agriculture on one of the State Grange scholarships, of which there are twelve open each year by competitive examination to members of the Grange between the ages of eighteen and twenty-five. Full information may be obtained from the Pomona Masters.)

The study of nature brings the school and the home closer together. In nearly all cases the parents feel that the children are learning something worth while, something that will always be theirs and that will help to make them useful men and women.

I have my blue days, when I feel discouraged, but I suppose we all have them when things go wrong in school. Children are not angels, and I should not like them if they were, and, of course, they get obstreperous sometimes. Then there are the dull ones that it seems impossible to interest in anything, but usually we can find something that they are interested in if we try hard enough.

This year I have the pupils from two districts and also two pupils from a third. There are twenty-three pupils, the youngest less than five and the oldest fifteen. I have all grades except the fifth, two high school subjects, and the sewing project, which we have after school three times a week. I have never enjoyed teaching so much before, although I must admit that I find from two to three hours more of work to do outside than I did with ten pupils.. But there is such a spirit of interest, good fellowship, and cooperation, that everything works splendidly.

The first nature study we did this fall was on leaves. On Columbus Day the children all wanted to come to school so we took a good share of that day for an organized field trip. We started out with paper and pencils, and each child old enough to write put down the names of trees as I pointed them out. We saw thirty-two different kinds, fruit, roadside, field, and forest trees. One boy thirteen years of age knew twenty-nine, another, twenty-seven, two, twenty-five, and so on. Only a few knew less than twelve. One boy eight years old knew twenty-one. I have never gone on a trip with children before that was so successful. Of course, we pointed out important characteristics as we identified the trees. The boy who was most disinclined to take pencil and paper has asked to do the same thing again. I think that we shall too when the leaves are all gone and again when they are budding in the spring, but we shall go in different directions from the school. I am sorry that we could not do more in the study of weeds earlier, but as school started late, and as I found it took some time to get my new pupils organized for good work, I neglected the weed work a bit. Last spring we did quite a bit, so that we shall have an entry both in weeds and in wild flowers for Farmers' Week.

We have done quite a bit in the apple work. The interest is growing, and during the next two or three weeks we hope to accomplish more. We have taken one trip to a poorly kept orchard, and this week we expect to visit a well-kept one.

In the poultry study I plan to visit the poultry house and yards of a very successful poultry woman in the district, and possibly go to the homes of two of my pupils. One of these girls takes all the care of over a hundred Rhode Island Reds and in spite of not very modern conveniences and methods has very good success. She has promised to bring a pet hen to the school for a few days.

If you could have stepped into our schoolroom this noon just as I was leaving for about ten minutes to go on an errand across the way, you would have found one of my oldest girls helping some of the younger ones in rehearsing their parts for a Christmas play, in the hall the two oldest boys, assisted by two or three younger ones, busy building our terrarium, by the desk two girls busily copying their parts to the play, and in the yard several playing. I could not help feeling proud of such an enthusiastic group.

(*Editor's note.*— This teacher attended the summer school at the State College of Agriculture at her own expense, and has done wonderful work during the past year.)

As my work is with the two primary grades, nature study is not entered into with so much detail as in the older grades; but we are very deeply interested in it. The principal suggested that many of your questions would be answered if I wrote of our terrarium and the use we have made of it.

The terrarium was made to fit a window sill. The two long sides are of glass, the ends and the cover of wire netting. It contains about three inches of good soil. In one end is a sunken dish for water. We sow grass seed as soon as school opens in the fall, and it grows all winter.

At various times we have had snakes, toads, tree toads, turtles, lizards, beetles, katydids, cicadas, June bugs, dragon flies, bees, spiders, crickets, grasshoppers, caterpillars, butterflies, moths, cocoons, tomato caterpillars, milkweed caterpillars, a robin, a bluebird, a wren, and a goldfinch. Nearly all the specimens were brought by pupils and quite as often by pupils of other grades as by my own.

Our time for nature study is as variable as Mother Nature herself. Whenever we are so fortunate as to have a special specimen, is our time for study. When a moth is emerging from a cocoon, we stop all other work to watch. Always when we have something of special interest, we notify the biology teacher who often comes with the entire class. The teacher of biology uses our terrarium at every opportunity.

CHARACTERS IN *HIAWATHA AND THE BIRDS*

District 10, Town of Savannah, Wayne County

Last winter we had two butterflies which we kept nearly all winter and fed sweetened water. They became very tame, and after a time, whenever I picked one up, the proboscis would uncoil and feel about for the drink. The children often brought fragrant flowers and watched the butterflies search for the honey. We have seen the crickets making music, we have seen them eat and have learned the food they like by feeding them; we have watched caterpillars spin their cocoons, hang themselves and change into chrysalids, or bury themselves in the earth; we have seen grasshoppers and katydids deposit their eggs in the earth, and moths and butterflies sticking theirs fast to twigs, grass, and the like. Many of the grasshopper eggs hatched, and only seeing made us realize that the baby hoppers were so tiny. They hopped through the meshes of the wire and out of doors.

All these things and many others that we learned, we might have found in books, but it is certainly much clearer and more interesting to actually see the things happen. I might add that I have learned quite as much as the pupils in this objective study.

One day last spring a robin was found entangled in twine and hanging by one wing. The wing was not broken but badly strained; so we put the robin in the terrarium for a while, then let him hop about the room the rest of the day. The boys brought worms to feed him, and while getting enough to satisfy one bird, gained quite an idea of the number it would take to bring up a family of little ones.

The bluebird had, in some way, become so covered with mud that it could not fly. We washed the feathers carefully and kept it until the feathers were dry, then all went out in the yard to see it fly away. I shall never forget the glad chirp when it flew away, and the children said, "The bird said, 'Thank you.'" The wren I found in the house and took to school. It became so tame in one day that it would rest on a desk or my finger and catch flies. We kept it one day, and it caught dozens of flies.

In our close study of these birds the pupils gained an interest in birds that they could not have obtained in any other way. Last year after we had studied birds for

some time, we gave a little play, ***Hiawatha and the Birds.*** I am enclosing a snapshot of the characters. We have an Audubon Society and the Audubon leaflets and buttons, and every spring we have a Bird Day program. The pupils take entire charge of the program on that day and help to plan it beforehand.

Last spring one special object of study was the apple-tree caterpillar. The class kept a record of the number of worms and nests destroyed. One object lesson with a tomato worm and a handful of leaves sent the class home " hunting worms."

A lady found a large spider with " a ball of something," and she sent both to me. I told the children what the ball was and put it in the terrarium. One day months afterward, a boy discovered little spiders coming out of the ball, and then the excitement that prevailed! Hundreds of spiders appeared, such tiny things, and how they worked! Yards and yards of web covered everything in the window. It seemed incredible that such tiny things could have done so much. They carried the web to the top of our big window, then outside, and down the window.

We often go for a field lesson, sometimes to gather seeds or plants for study; sometimes to study the trees, and sometimes just " to use our eyes." On the days following such trips we have unusually interesting oral and written English.

Nature study helps wonderfully in the reading and use of books, for the children are always eager to read about anything they know a bit about, and I often hear, " Oh, we know about that, we've seen it." I feel that nature study helps and broadens our work in every direction.

THE URBAN VIEWPOINT

It must be clear that there can be no fixed line of demarcation between teaching nature study in rural districts and teaching it in centers of population. There will be every possible gradation between the one-room district schools and the schools in New York City. Yet the fundamental principle must hold true for city as well as for country. The

CHILDREN IN CITIES RESPOND TO " THE GREEN THINGS GROWING "

work must be done in contact with actual material, with real things. It is quite surprising to the uninitiated what a variety of material may be found to exist even in large cities. The letters that follow bring out this fact. Moreover, in these days of automobiles, many city children

are constantly riding out into the country. They may be made messengers to bring specimens and reports of experiences to the classroom and to their less fortunate schoolmates.

Probably a larger proportion of the nature study work in urban schools will be done in the classroom than is the case with rural schools. The regular work is more closely graded, and the time more completely prescribed. Moreover, pupils cannot so easily or so readily be taken out and brought into contact with living forms unless there be a park close at hand. Yet some trips are quite possible, and the daily lives of the children will contribute material just as do those of country children. It should be remembered in this connection, that nature study means the relation of the child to his environment. A city presents many opportunities that the country does not have, such, for example, as department stores with endless types of textiles, rugs, clothing, and the like, completely equipped butcher shops, bakeries, delicatessens, groceries, fruit stores, and a multitude of other stores and manufacturing plants, all of which may contribute to the nature study work if wisely used. The balance is by no means all on the side of the country.

Naturally conditions and facilities will often make the emphasis in urban nature study come on different topics or on different phases of a given topic than it does in rural teaching. There will be no less value in either case if the work is well guided and alive with interest. The main point always is that it shall be real, and not out of a textbook. It would be just as futile and deadening for a country school to read in detail about a great bakeshop without seeing one, as it would be for a city school to read in detail about a field of wheat without seeing one. It is perfectly proper for each to know, in a general way, that the other exists, and thus to be ready, should the opportunity come, to have contact with it; but the emphasis of the country school should be on the wheatfield, and that of the city school on the bakeshop. This illustration may serve to make the matter clear. The principle is the same in all cases.

In gathering the testimony from village and city teachers, a letter was first sent to the superintendents of schools asking for the name of some teacher who was doing good work. As the names came in, a request was sent to the teachers for statements, and it is from the responses to that request that the following extracts are taken.

As a guide to those who read these letters, it has seemed desirable to give some indication of the size of the urban center concerned. This has been done by using the word *village*, *small city*, or *large city* at the head of each extract. In this classification a village has from 5000 to 10,000 population; a small city, from 10,000 to 50,000 population; and a large city, over 50,000 population. One letter from New York City is so marked.

The list of those teachers in villages and in cities who responded to the letter of inquiry is as follows:

Mary L. Arnold, Ithaca, Tompkins County
Martha B. Bayles, New York City
Florence M. Benson, Lawrence, Nassau County
Etta A. Bowman, Olean, Cattaraugus County
Emma B. Dashley, Syracuse, Onondaga County
Lena M. Elwood, Corning, Steuben County
Mrs. G. S. Fountain, Waterford, Saratoga County
Minabel Garrett, Albion, Orleans County
Florence M. Goetchius, Poughkeepsie, Dutchess County
Sophia Jackson, Jamestown, Chautauqua County
Martha D. Johnson, Lawrence, Nassau County
Sarah Lake, Owego, Tioga County
Edna J. Leidt, Buffalo, Erie County
Mary D. Lewis, Watertown, Jefferson County
Mary E. McCarthy, Malone, Franklin County
Mrs. A. V. Manville, Whitehall, Washington County
Katharine Pease Orcutt, Lawrence, Nassau County
Mabel Owen, Little Falls, Herkimer County
Ellis C. Persing, Wellsville, Allegany County
Maud E. R. Phalen, Penn Yan, Yates County
M. M. Reed, Little Falls, Herkimer County
Elizabeth M. Relihan, Corning, Steuben County
Nettie M. Sadler, Syracuse, Onondaga County
Gertrude Shepherd, Buffalo, Erie County
Minna R. Streich, Brooklyn
Dora R. Tanner, Medina, Orleans County
Sarah Waddell, Hoosick Falls, Rensselaer County
Cornelia Williams, Ithaca, Tompkins County

LETTERS FROM TEACHERS IN VILLAGES AND CITIES

SMALL CITY

I am very glad to tell something about the way in which we study nature. We do not have formal lessons. When a flower is brought to us or a bird song floats in, we just enjoy it.

We can observe many species of birds in the elm trees into which we look from our windows. We can note the colors and the habits of feeding, and can listen to the songs and call notes. As we hear them even in the midst of a recitation, it takes but a second to say, "Listen. What is it? Do you remember?" Children will without the least intention of falsifying *see* the colors of some bird picture on the first English sparrow flying by; therefore we try to cultivate careful observation and accurate description, never adding a bird to our list unless we have seen it together. Of course other points to be emphasized are the economic value of the birds and the sin of wearing their plumage on hats.

Among the insects, we notice very often bees, ants, butterflies, and giant moths. A neighbor had a hive of Italian bees, which aroused special interest. The class paid them a visit, and the owner told us many interesting facts as he handled them. We placed the fragrant blossoms of the apricot on a table near the window. The bees flew in and out much to our delight. Even the most timid child finally ventured to sit close by and observe them with the large magnifying glass. Large moths frequently emerge from the cocoons in our terrarium, and sometimes we even have a butterfly.

A monarch butterfly brought in at the first frost may be easily trained to drink sugared water from the fingers. The children are interested in the mouth parts of these insects, comparing them with the fly and the bumblebee.

Snails are very interesting pets. They seem perfectly contented in the terrarium. All they need is moist sand, lettuce, and a dish of water. Their graceful and dignified progress to food or water is delightful to behold. Sometimes we have been fortunate enough to see one digging the hole for its nest. The quick half-turn of the body as the "foot" is pressed into the sand soon excavates the cavity to about an inch in depth. Then the eggs are deposited and covered. No pearl is more beautiful and lustrous than a snail's egg. After some time in the terrarium the mother snail seems to lose her desire to conceal her eggs and does not cover the opening. Indeed the eggs will fill and overflow the nest. This confidence in her surroundings was once misplaced. A small green salamander dwelt near-by. One morning he could not be found. A diligent search revealed the tip of his tail protruding from Madam Snail's nursery. Of course he was promptly drawn out, but we noticed very few baby snails that year. When the eggs hatch, we show the tiny snail by placing it on a piece of white paper. The shell and the horns are perfect in shape.

Wild flowers are identified by the children from the flower book. They are sometimes planted by the schoolhouse or taken to the home garden. Every child is encouraged to make a wild flower garden of his own, studying the location needed for each variety. We like to think why the flowers have colored petals and to study the different means of pollen transmission. One winter we had a study of biennials, using a beet, a parsnip, a carrot, and a cabbage. These in due time bloomed and fruited, and we even germinated some of the seeds, thus completing the cycle.

These are only a few of the many ways in which the out-of-doors may be brought into the city schoolroom. It works out best to make a special study of but one thing at a time while noticing and enjoying every thing.

As the grades advance more and more, a crowded curriculum forbids more than a passing glance at nature work. However, we can at least keep alive in the child that love of nature which is his heritage. Then in later years when sorrows and responsibilities weigh sorely on him, and he cries out, as we all have done, "Is it worth while? Is life worth living?" mayhap a single glimpse of a green pine against the blue sky will tell him, "Yes, this makes it worth while indeed."

SMALL CITY

It seems as though there were three problems in this work, rural, small city, and large city. My viewpoint is that of the small city.

Here we have children who have never seen pigs, lambs, or poultry alive, or wild flowers in their native woods, also those who have seen all of these, and those who have seen some.

If you came to our school, you would find no period on our program devoted to nature study. Our pupils are young, none over the third grade, and for such young children nature study has seemed to me more of a matter of atmosphere than of formal study. Anyhow our pupils seem to contract a liking for the outdoor world that lasts them for life and makes them satisfactory pupils in the high school science classes later. * * *

We use poetry to rub it all in. One mother told me that one of her happiest moments was when out riding one day with her children one of them as they drove by along a little brook repeated Tennyson's *The Brook*. She did not know that the child knew it. One day I was walking into our park and was joined by a little girl from our school. As we went up the hill, the bobolinks were singing, and she turned to me and recited *Robert of Lincoln*. And I had thought that her teacher had given too old a poem to her class!

NEW YORK CITY

We are much interested in nature study and consider it of great value. It not only creates a love for God's out-of-doors, but it makes clear the many allusions to nature that are found in literature. We emphasize it, making it the basis of most of our English composition, oral and written, in the first three years. As a result our little East Siders have a keener appreciation of birds, animals, flowers, and insects than many country children. The development of a hard bean or an ugly bulb into a thing of life and beauty, to them is not an ordinary occurrence but a miracle.

With the bulb study we are using Maltbie B. Babcock's *Surprise*. In fact we believe that all these lessons should have a literary approach. More than this, we correlate them

with every other subject as far as possible. For instance, the third year class in studying the butterfly uses Swinburne's *White Butterflies*, and the story of *Dan*, which gives the metamorphosis of a caterpillar into a butterfly. The latter the pupils dramatize. Then both butterfly and cocoon are painted from the objects. Finally after much oral work, short compositions are written.

In the fifth year class we have a Burroughs Club. Each month we receive ten questions the answers to which are to be found in John Burroughs books. The interest thus aroused in a great naturalist and his works we feel will be of lasting value.

Of course, little worth while can be done without illustrative material, which we are fortunate enough to get although we are in the most thickly populated part of New York. It hardly seems possible that one could step from a dirty city street filled with pushcarts into a garden aglow with hundreds of tulips, hyacinths, and daffodils, or into a school in which every room is decorated with "green things growing." It sounds like a fairy tale, but it is true with regard to our school. Many classes raise plants from both bulbs and seeds in school and at home. This year we have seventy-one garden clubs planting flower and vegetable seeds sent to us from Washington, D. C. Some are buying corn and beans for window boxes, and thirty or more expect to have gardens in their back yards. Then our country friends are very good to us. One suburban school at the suggestion and aid of its mothers' association has been very generous in its gifts for several years. The American Museum of Natural History sends us cases of shells, insects, stuffed birds, and animals, and the alumnæ of Hunter College supply us with twigs and frogs' eggs, while the Aquarium will give us everything except the vessel for a salt-water aquarium.

Excursions to the parks and semiannual visits to Washington Irving High School to see the vivarium and to have illustrated lectures supplement the work done in school.

VILLAGE

This has been the "stamping ground" of a great mosquito crusade. We have studied that insect rather exhaustively, discussing the duty of every one toward pools of water, garbage cans, and the like. We have correlated it with geography and composition work as much as possible.

VILLAGE

The special interest in my room now is in wild flowers. Each year while the ground is yet covered with snow we begin talking about the flowers that are to be. We learn the names of the parts of a complete flower from pictures or outlines drawn on the board. We spend a spelling lesson or two on these names. In this way interest is awakened, and the children begin early to bring in pussy willows, catkins, and the first twigs showing signs of returning life. We keep a list of all the wild flowers that are brought in. The name and the date of each new flower are put on the board. At the close of the week these names are added to a permanent list, which is hung where the children may consult it at their convenience. Some of them keep their own little notebooks and record every flower. This is entirely optional. One year in a school week of five days we averaged over eight new flowers for each day. This included flowers of wild shrubs and trees. No cultivated flowers were taken for the list unless they were found classed under wild flowers as "escapes." One June when the last day of the month came, we had recorded over two hundred wild flowers. A few of the children will usually continue getting specimens during the summer vacation.

We teachers are not botanists in any sense of the word. When we do not recognize a flower, we never hesitate to say that we do not know but that we can find out. We try to call attention to the most interesting things about the names of flowers — that some of them are called from the number of parts, as trillium, cinquefoil, and tick trefoil; that some have taken their names from some peculiarity in appearance, as jack-in-the-pulpit, bellflower, bellwort, yellow star grass, arrowhead, and turtlehead; that some are named from some characteristic quality, as tearthumb, bindweed, twisted stalk, and bloodroot. The children like to learn that the joe-pye weed, so noticeable in summer along the creek banks, is called by the name of an old Indian who once used the weed as a medicine, and that the dainty yellowish green flower with leaves so like the lily-of-the-valley has received its name, clintonia, from a man who was once the governor of our own State.

Incidentally we try to impress the fact that many of our so-called worthless weeds were considered of great medicinal value by the Indians, and that many are used as

medicine now and are, in some places, extensively cultivated for the drug market. In fact there is something of interest to be said about nearly every weed if there is only time to talk about it — how the Indians may have used the crimson juice of the bloodroot to decorate their faces and tomahawks, and how the colonists at the time of the Revolutionary War used the leaves of the New Jersey tea (just such as we find growing on our cemetery hill) rather than touch the taxed tea from England.

One thing we consider is that many of our troublesome and noxious weeds were at one time the loved flowers of some garden spot across the sea. Some one really cared so much for them that he took the trouble to bring them across the ocean to beautify his new home, and now these weeds make trouble for our farmers.

Our idea in taking up the study of wild flowers has not been to see how large a collection could be brought in or how many flowers the pupils can identify. What we desire is to awaken an active interest in their surroundings, to open their eyes to the marvelous construction of even the most insignificant weed, to teach them that every

CHILDREN DEVELOP BY CARING FOR LIVING THINGS

tiny seemingly worthless blade of grass has been the subject of careful study and an object of interest to great students of nature. When a child once begins to open his eyes to these things, he looks on a new world and finds a delight in his walks and rambles that otherwise could never be his. A child has a right to have his attention called to these things. If he is deprived of them, he loses something of the heritage that is rightfully his and that cannot be regained. If he has his interest awakened, life has for him a charm that it cannot otherwise possess. He can find " tongues in trees, books in the running brooks, sermons in stones, and good in everything."

LARGE CITY

I am very much interested in nature work and, being a kindergartner, have more or less nature work all through the year.

In the fall, we gather caterpillars and watch the cocoons being made, and also gather cocoons; take walks to see goldfish and birds; watch squirrels gathering their winter store of nuts; talk of the migration of birds and about the farmer and his work of harvesting for winter. Later we watch for the winter birds. We pay quite a little atten-

tion to the moon and the groups of stars. I draw pictures of the Big and the Little Dipper, the North Star, Orion and his Belt, and the Pleiades.

In the spring, we watch for the moths and the butterflies from the cocoons; plant seeds in eggshells or jars or on cotton, and watch the growth; watch for the birds as they return and build nests; take walks to see flowers, streams, birds, and fish; gather frogs' eggs and watch their growth. The latter we find intensely interesting. I put them in a very large fish globe, and their four feet usually develop by the time school closes or soon after.

I have a box of about thirty nests that have been given to me or collected. Each of our kindergartners has Audubon bird charts 1 and 2, and most of the children can name the majority of the birds. They watch for the new birds, and are anxious to point out on the charts the birds seen. Six or eight of the children have induced their fathers to build birdhouses this spring and have brought them to school for us to see. We dramatize the nest building of the birds and the transformation of the caterpillars. We spend a couple of weeks on the forces of nature — wind, light, and heat. At Thanksgiving time we make butter in the kindergarten by churning cream, and spread the butter on crackers for a party. This makes a firm impression on the children.

We also take up gardening and the farmyard animals, in that way teaching the spirit of nature in the former, and the fostering care in the latter. In all of these, we have talks, show pictures, and tell stories. I feel that this work opens the children's eyes to the beauties about them, and certainly makes them more observing. When out in the country or driving, they seem to be on the lookout for these things and tell about them. They learn of the value of the toad and the birds in ridding our vegetables and trees of worms and caterpillars. By being interested themselves, they naturally interest their parents.

The nature work occupies a very important part in our program. I think the children manifest the most interest, as a whole, in the stars and constellations and the birds.

VILLAGE

It is very true that we have to work at a disadvantage in towns for lack of the material in natural surroundings. But after studying the leaflet very carefully with the idea of seeing what work could not be used by us, I find very little. With the movement now on foot for cultivating waste land and gardens in towns, almost all the work on plants and soils can be used. There are very good articles usually given on horses; much of that I can use, for some of my boys take up general delivery work here in town and I hope that their care of horses is such that the horses will have happier lives because of the facts their drivers learned in school.

The insect section we can use to good advantage. We have cocoons, some already hatching. The bird part is about the best of all, especially the material on the date of arrival, birdhouses, and nests in the September issue. You have abundant material in your leaflets, much more than we have time for. That is our greatest trouble this year — lack of time. Still I feel that I could not teach without having some nature study, for I know what it has meant to some of my boys and girls in the past; therefore I continue to do as much as possible.

LARGE CITY

In trying to enumerate our resources during a discussion this week, we were surprised at their variety and number. Perhaps a list will give you the best idea.

1. Animal study: pet dogs, cats, rabbits, canaries, even hens sometimes; goldfish, salamanders, frogs' eggs; squirrels in the trees about the school building.
2. Bird study: not what it ought to be. An Audubon society can be formed and birdhouses built. We have a few stuffed birds and can observe the more common ones in the living state, English sparrow, robin, woodpeckers.
3. Insect study: cocoons, caterpillars, and any other forms that can be kept for a time and studied.
4. Plant study: plants in every stage of development may be brought in; experiments can be made to determine essential conditions for sturdy growth; eggshell gardens, window boxes, sand-table gardens, and in a few places outdoor gardens may be made; bulbs are especially good because many can be grown in water where the children can see every change that takes place.
5. Tree study: in walks with the children and about the school grounds, trees can be found for study.
6. Earth study: soils, winds, weather, can be studied by excursions, simple experiments, weather records, and the like.

PART I

LIST OF SUBJECTS FOR 1917-1918 IN NATURAL HISTORY AND IN ELEMENTARY AGRICULTURE AS OUTLINED IN THE NEW YORK STATE SYLLABUS

BIRDS

For special study, the nuthatch and the hen; to be recognized, any two other winter birds and any five of the following: oriole, goldfinch, phœbe, grackle, brown thrasher, meadow lark, cliff swallow, black and white warbler, peacock, eagle.

ANIMALS

For special study, the cat and the cow; to be recognized, any four of the following: goat, fox, skunk, muskrat, frog.

INSECTS

For special study, the potato beetle or the lady beetle, and one biting and one sucking insect; to be recognized, any four of the following: potato beetle, tent caterpillar, honeybee, ant, hornet, spider.

PLANTS

For special study, the potato; to be recognized, one of the clovers, one of the grains, one of the grasses, and any six of the following: willow, cherry, daisy, marsh marigold, anemone, trillium, partridge berry, black medic, squash, turnip, pitcher plant; to be studied, any four of the following weeds: bindweed, purslane, thistle, wild carrot, pigweed.

TREES

For special study, the locust and one conifer; to be recognized, two kinds of fruit trees, one conifer, and any four of the following: hemlock, spruce, cherry, quince, horse-chestnut, alder, elm, poplar, tamarack (larch).

BIRD STUDY

THE EDITOR

IT is apparent that the study of bird life is the most popular phase of the nature study work. This is especially true in the case of those schools that are just beginning to find the pleasant and profitable resources of their environment.

Bird study is one that lends itself to all places and to all seasons. Even in the largest cities there are always some species that can be discovered in addition to the ever-present English sparrow, and experiences that have been related serve to show that one never knows what may be discovered when interest is once aroused. As to the proper time to begin, it has no relation to the calendar, but is far more concerned with the occasion of some first-hand experience with bird life that has proved interesting and stimulating.

It is not necessary that a teacher be an expert student of bird life in order to inspire and conduct bird study successfully in the school. It is necessary, however, that the teacher be familiar with the various ways by which bird study may be undertaken in such a manner that there will be first-hand contact with the birds. Among the most familiar and useful methods of approach to the work are the following:

Making a collection of birds' nests
Feeding birds in winter
Building birdhouses
Keeping a bird calendar
Taking field trips to study the birds
Celebrating Bird Day
Forming Junior Audubon classes

Most inspiring accounts come from teachers who have been successful in developing worth while bird study. Two of these will serve best to indicate some of the ways in which the various methods of approach are used.

When I commenced teaching nature study, the pupils knew nothing about it. As a beginning we collected birds' nests. We soon had a large collection, but we did not know which birds inhabited the different nests; so we commenced to search for material that would tell us about birds' nests. This was not satisfactory, and in the spring

each one looked for birds and watched them building or found where they had built, but always being careful not to disturb or frighten the birds. As we knew so few birds in the beginning, we found that we had plenty to do to identify our birds. This led to our keeping a bird calendar. The first spring we identified thirty birds; not many, but thirty more than most of us knew the fall before. Now we can correctly identify many more.

We began our bird study in January. January? Yes. I'll tell you why. One of my girls had seen a common English sparrow and did not know what it was. On questioning the pupils I found that about all the birds they really knew were the robins and the blackbirds. I was amazed. This section is alive with birds. I happened to have on hand a flat wooden box. Two of my boys nailed this to a fence post outside the window, and I told the children to place the scraps from their luncheons in the box and then just wait and see what would happen. In a few days chickadees came, and then nuthatches, downy woodpeckers, and hairy woodpeckers followed. We were very busy watching them, as you can imagine. As soon as the pupils could distinguish between these birds, they began to look elsewhere for them and to attract them to their own homes. As soon as I had them safely on the track of watching for the birds, I held back and let the subject teach itself with only a little guidance. From March first to April first the children have recognized twenty-one migratory birds and are still watching for new arrivals and new nests of the old. I devote ten minutes at the opening of the morning program to a discussion of the birds seen. Each pupil who has seen a bird describes it to the class. These are a wonderful ten minutes some mornings.

In addition to knowing various devices by which bird study may be opened to the children, teachers should know the simple standards that apply to the description of a bird for the purpose of identification, to the description of a nest for the purpose of identification, to the proper establishment and maintenance of feeding stations, to the observations that should be recorded on a bird calendar, and to the construction of bird-houses. These matters are discussed more fully in the following paragraphs.

IDENTIFICATION

Children are constantly seeing new birds, and very often come to school with the most impossible descriptions, making it quite out of the question to determine what bird it was that they saw. It is sometimes difficult to distinguish the markings on a bird, especially if it is seen against a strong light, and it requires patience and practice to enable one to obtain a description of a bird seen for the first time that will make possible its identification. Yet this is one of the fundamental considerations in bird study and should be thoroughly understood and constantly strengthened. The points on which the identification of a bird is based in the order of their importance are as follows:

1. The size as compared with the three standard types: the English sparrow, the robin, and the crow.
2. The general color above and below.
3. Any specific color markings that are noted, such as the red patch on the head of the male woodpeckers or the black bib of the chickadee.

4. When and where the bird was seen. In the case of some of the sparrows, for example, it aids greatly in determining the species to know whether the bird was seen in the open fields or in shrubbery.
5. The kind and the color of the bill and the feet, if it is possible to see them. A striking example of a characteristic bill has been found in the description of the grosbeaks, which have been unusually numerous during the past few winters.
6. Any peculiarity of flight or action. Examples of this are the bounding flight of the goldfinch and the way in which the phœbe bobs its tail.
7. The song. Many bird songs can be imitated more or less closely with practice, and they are exceedingly characteristic.
8. If the nest and eggs are discovered with the bird, these also are of service in establishing the identity of the species.

When a bird description is brought to the school there are several ways by which it may be possible to identify the bird. Every school should have the folio of bird plates furnished by the State Department of Education in 1915. These are very valuable from a pictorial point of view. A question that has troubled many teachers is that of preserving these plates in good condition and still permitting their free use. We should all appreciate having suggestions from any teacher who has successfully solved this problem.

A good bird book, of course, is the most authoritative method of identification, for it gives a complete, detailed description, and it sometimes happens that two species are very much alike except for slight characteristics. Every year more and more schools are adding bird books to their libraries, and if the school does not have any book on birds, it would be desirable to recommend in the next list for purchase some such book as Chapman's *Handbook of Birds of Eastern North America*, Reed's *Bird Guide*, Dugmore's *Bird Homes*, or any other work that is standard. (See list of reference books on page 318.)

There are often persons in the community who have considerable knowledge of bird life, and they are always glad to be of assistance to the school. It frequently happens that when other means have failed such a person has been able to identify the bird that is under discussion. It is always wise in any subject to use the community as far as possible, for it strengthens the bond between the school and the home.

As a last resort the bird description may be sent to the College of Agriculture, and, if it is at all complete, an accurate identification can easily be made.

COLLECTION OF NESTS

In the first letter quoted on page 32, there is a very good discussion of the methods and results involved in the collection and study of birds'

nests. With very few exceptions birds build new nests each year, and there is no harm in appropriating the old ones. This work is most often done in the autumn when the leaves have fallen from the trees and revealed the birds' nests. It is often exceedingly difficult, however, to make sure of the identity of a nest if it is then seen for the first time. Yet many nests are quite characteristic, and the article given in the September 1916 leaflet on page 44 will be found to be of service in nest identification. In case local means fail, and the nest description is sent to the College for identification, reference should be made to page 36 of the September 1916 leaflet, which gives the standard form of nest description. Of course, the most satisfactory and worth while nest study results when in the spring and summer the boys and girls locate the nests as the birds build and occupy them, and are thus able accurately to identify the nest from the bird. Caution should always be exercised in approaching and observing birds at the nest, because they are rather easily disturbed at the nesting period, and may often be caused to desert the nest. It is very valuable likewise to know how many birds are nesting in a given locality, and how successful they are in rearing their young. Such a study is likely to reveal the enemies that birds have to struggle with and may teach many valuable lessons in this connection.

COLLECTION OF BIRDS' NESTS AT SCHOOL
District 4, Town of Phelps, Ontario County

A good way to preserve nests is to mount each one on a neat sheet of cardboard, and to include with it a drawing or a picture of the bird and a short composition or story of its characteristics and habits (page 310).

WINTER FEEDING

In a letter from a teacher the following paragraphs occurred:

Never before until the pupils read the leaflets this year, did they think of feeding the birds. It was surprising to see how much pleasure they derived from gathering all the crumbs from the noon luncheon and putting them out on the feeding station which the girls constructed from a board and a barrel hoop broken in two, over which there was a branch from the Christmas tree.

Better still, the chickadees would light right on the pupils' hands and eat crumbs. Next came the nuthatch, a bird for which I had been looking for the past two years.

From the feeding station they next came right in on the window sill while the window was open, and picked up the crumbs there.

There are several reasons why feeding the birds in winter is one of the most satisfactory methods of bird study. In the first place there are fewer species present in the winter, and it is easier to identify all those that come to the feeding station. In the second place, feeding the birds offers an excellent opportunity for first-hand contact and study, and it is no exaggeration to say that the child who has been so fortunate as to have a wild bird eat from his hand has had his whole attitude and outlook to life changed. Last, but by no means least, it is a praiseworthy and profitable practice to care for the birds during the season when it is difficult for them to find food, and it brings about a greater realization of their importance and value.

PHOTOGRAPH BY A. A. ALLEN

SUET FASTENED TO THE WINDOW CASING WILL ATTRACT WOODPECKERS

Hairy woodpecker, about one-fifth natural size

Those teachers having access to the September 1915 leaflet will find a complete discussion of winter feeding in Dr. Allen's article *How to Attract Wild Birds*, which begins on page 76. The points to remember are also given on page 37 of the September 1916 leaflet.

BIRDHOUSES

Reference should be made again to the article on page 51 of the September 1916 leaflet, which gives a full discussion of birdhouses. Teachers who have come into the work this year may obtain a copy of the 1916 leaflet by addressing the Editor, Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York.

PHOTOGRAPH BY A. A. ALLEN

JUNCO AT A WINDOW FEEDING TRAY

About one-fourth natural size

Any person who has had the experience of watching a pair of birds nest in a house that he has built, will understand the advisability of bringing a similar experience into the lives of boys and girls. The lessons that result in increasing the knowledge and building the character, are immeasurable. One teacher wrote as follows:

Early last spring my pupils made birdhouses which they brought to school. One boy had an extra fine one, and so all decided to place his in one of the apple trees in our yard. The house had not been placed but a few days when one morning soon after school called, a little first-grade boy whispered to his neighbor, "There's a bird in our house." Soon the glad news had gone the rounds of the room. I told the children that they might pass quietly to the window where all could watch the proceedings. Two bluebirds were busily engaged in carrying material within the house for their nest. How the work did fly in our room for the rest of the day! It seemed as though "our bluebirds" put vim into all our work. At noons and recesses for several days the children would not play in that part of the yard, and one day one little girl nearly came to tears when she heard an older boy whistling, as she thought, too loudly near the birdhouse.

PRIZE BIRDHOUSE, FARMERS' WEEK, 1917. ONE-SIXTH NATURAL SIZE

From District 5, Town of Norwich, Chenango County

BIRD CALENDAR

Many teachers have found the keeping of a bird calendar one of the most interesting and profitable ways of stimulating bird study and observation, beginning early in the spring with those species that have been winter residents, and adding each new species as it returns from the South. There are schools that have, in the course of the season, been able to recognize more than one hundred different kinds of birds. Even though teachers and pupils are familiar with only a very few species at the beginning of the season, there is no reason why a calendar may not be kept with the result that in any given year a great many new birds will be seen. Of course as the list grows larger and larger, it is more difficult to find new species to add, but the zest and the enthusiasm become all the greater, and there are some schools that have reached the point where they are able to go into the more intensive and difficult study of the sparrows, warblers, and some other families.

We are fortunate this year in having a discussion of migration and bird calendars by Dr. A. A. Allen on page 41. The following paragraph from a teacher's letter tells of her experience in keeping a bird calendar, and it may be added that this particular one, consisting of drawings and records together with a book of stories, was awarded second prize at the Farmers' Week exhibition last year.

Last spring as we began our usual bird calendar, I suggested that the child seeing the bird should trace its outline (some teachers prefer the drawings to be made freehand) from the portfolio of birds sent to us by the State and color then true to nature with crayolas. I had never seen this done; but the results were far beyond my expectations. Afterward we made a notebook of the eighty birds seen, telling of their songs, their nests, their habits, their food, their range, and the like. It would have been much

better to do this at the time the bird was first seen. Since then the children have made other charts of our winter birds, and this spring are drawing only those not seen last year. Their notebooks gave them much work in English and valuable practice in learning to use books of many kinds to find facts they could not otherwise give, as well as in arranging these in working order. I think that this work is excellent, as many grown-ups do not know to what authorities to go for information that they may need.
Together we are enjoying Mabel Osgood Wright's *Gray Lady and the Birds*, and our copy of Reed's *Bird Guide* is torn to tatters.

FIELD TRIPS

Many communities have reached the place where they recognize the value of taking the school on field trips. There should always be some definite object in mind, even though the senses are alive to all the experiences revealed on a trip. One of the most interesting kinds of field trips relates to bird study. Of course one who is familiar with bird life realizes that the most satisfactory times for studying birds in the field are the early morning and the early evening. There are many teachers who have reached the point with the children where it has been possible to go on trips at one or the other of these times. The lessons that come to the children from such an experience are numberless, in addition to the unfamiliar birds that they will discover and to the new observations which they will make upon those they already know. The essentials of bird study are quietness, patience, and control. Ideally, of course, a person should study birds alone; but there is no reason why several may not go together with good results, and very often, if the attitude is right, a larger party may discover many kinds of birds in the course of a field trip. The teacher will find that such an experience will serve as few other things can to create a bond of sympathy with the children, and, rightly used, it may prove an incentive and stimulus to better work in all directions.

The study of birds in the field may well be connected with their economic value. It is sometimes necessary in order to obtain the cooperation and sympathy of the community, particularly of the men, to show that the activities of the school have a practical value; and while bird study is desirable from its æsthetic side, it nevertheless has very practical value because of the service that birds render in the control of insect and weed pests. Whenever possible, it would be well to emphasize the importance of this service and to study the food habits of individual species.

BIRD DAY

For some years past the State Department of Education has designated some Friday in April of each year as Bird Day, and many schools have held interesting and profitable celebrations. It should serve as an opportunity to demonstrate to the community the work of the school, and the worth while character of bird study. It should in all senses of the

PRIZE BIRD CALENDAR, FARMERS' WEEK, 1917

From District 5, Town of Pharsalia, Chenango County. There are five long and narrow sheets which were bound together. In the photograph they are laid side by side. The birds were life size, were traced, colored, cut, and pasted with label giving data regarding observation. The drawings were accompanied by a descriptive notebook containing a page for each bird. (See text.)

word be an occasion when the work is summarized, when the school takes account of what it has accomplished in bird study through the year, and makes plans for the future.

JUNIOR AUDUBON CLASSES

The recognized association for the promotion of bird study and the protection of bird life is the National Association of Audubon Societies, with headquarters at 1974 Broadway, New York City, in charge of T. Gilbert Pearson, Secretary. This association stimulates, as a part of its activities, the formation of Junior Audubon Classes in schools and among groups of interested young folk. Hundreds of schools in the State have become affiliated with the Audubon Association, and it is one of the most helpful things that can be done. The local classes may be organized as a club, and children are always interested in such an enterprise.

THE USE OF LITERATURE AND SONGS

The realms of literature and of music are full of response to bird life, and the teacher would do well to bring the children in contact with these other resources through a common interest. The bird quotations given on page 67 will be helpful in this connection. The bobolink's song, which was published in one of the leaflets for children two years ago, proved of great interest; there are other bird songs that are good. It is even possible that in the realm of simple dramatization bird study may be a contributing factor; in fact in one school the children took great delight in representing different species of birds for the others to identify.

THE MIGRATION OF BIRDS

A. A. Allen
Assistant Professor of Ornithology

FROM the whole field of nature one can select no more engaging study than that of bird migration. The brilliant colors, the sweet songs, and the interesting habits of birds enchant and invite to further study, but the mystery that enshrouds their travels will always hold us fascinated. The strange calls from the clouds at night, the passage of the well-formed flocks of ducks and geese by day, the flashing of new wings through the garden, and the return of familiar voices, inspire us to wonder at the power and precision of the guiding sense that draws birds back each year to their homes of the previous summer. Every August the bobolink, leaving the fields of New York State, travels five thousand miles to the pampas of Brazil and, with even greater punctuality, comes back the following May and hovers over the same fields and alights on the same fence posts.

It is not surprising that birds in migration have fascinated mankind, not surprising that governments employ scientists to study and investigate them, and little wonder that thousands of people, scientists and laymen, spend much time following the birds in an effort to learn their secret. The facts that have been discovered have relieved us of much of our ignorance, but the great mystery of how migration originated still remains, and at best we can offer but theories to account for it.

Let us first consider some of the more interesting phases of migration upon which modern investigation has thrown light. It is now a matter of common knowledge that all birds do not migrate. Many species are able to accommodate themselves to the rigors of winter and never pass out of the neighborhood in which they are raised. The chickadees, the nuthatches, and the woodpeckers that come to feeding stations in winter in the northern United States, remain in the spring to nest in the vicinity, while in the South the familiar mocking birds and cardinals are ever present. The farther south one goes, the larger is the proportion of non-migrant birds, until, in the tropics, probably no real migration occurs. Even there, however, the coming and going of our northern species are conspicuous features of the bird life, and there is probably no place in the world where migrating birds are never seen. In places of the same latitude, however, migration varies, reaching its maximum in the eastern United States and western Europe, and being much less pronounced in the southern than in the northern hemisphere.

Between the birds that do not migrate at all and the arctic tern, which migrates 10,000 miles twice a year between its antarctic wintering ground and the arctic shores where it nests, there are all gradations of migrants. Some birds, such as the meadow lark, the robin, the bluebird, and the chipping sparrow, which nest throughout most of the United States and Canada, merely withdraw into the southern part of their breeding range during the winter, while their places are taken by such birds as the tree sparrow, the snow bunting, the pine grosbeak, and the siskin, which nest in northern Canada and migrate in winter as far south as the northern United States. Other species that nest in the northern United States and Canada, such as most of the flycatchers, the warblers, and the vireos, pass out of the United States entirely and spend the winter in Central America or in northern South America. A few species, such as the bobolink, the nighthawk, and the golden plover, pass over the mountains of northern South America to winter on the pampas of Brazil and Argentina, while a few of the shore birds, the knot, and the yellowlegs, for example, wander to southern Patagonia.

One of the strangest features of the migrations of some of these birds that winter in South America is that they pursue different routes in the spring from those in the fall. The golden plover, for example, which nests along the arctic coasts of North America, in the fall flies southeast to Labrador and thence due south to South America. A few stop along the Atlantic Coast, but the majority fly directly over the sea, a distance of about 2400 miles, to the north coast of South America and thence to Argentina. At this time of year they are never seen in the Mississippi Valley. In the spring, however, they enter the United States along the Gulf Coast, and all migrate up the Mississippi Valley, at this season never being seen along the Atlantic Coast. But this double route is the exception. The vast majority of birds just move southward after the breeding season, following the routes where food is most abundant, shunning areas where food is scarce, until they finally reach their winter quarters. In the spring they move northward along the same highways.

The fall migration is marked by much more dallying than the spring, and by much more wandering, some birds delaying their actual migration by trips to north, east, or west. There is no hurry so long as food is abundant, and some birds, for example the snipe, the woodcock, and many species of ducks, remain until pressed for food by the killing frosts, or by the formation of ice over their feeding pools. Many species, however, start southward while food is still abundant.

The fact that so many species leave long before food becomes scarce makes the reason for their going the more strange and brings us to the questions of why they migrate, and how they know when it is time. The

regularity with which birds arrive in the spring has been observed since ancient times, but it has not been until the modern investigations that we have understood the delicate physiological adjustment which records time for the bird almost as accurately as a timepiece. The physiological cycle is as precise in a healthy bird as is the revolution of the wheel of an engine. The bird's year begins with the slightest increase in the size of the reproductive organs, for these are not, as in some of the higher animals, of constant size throughout the year. The increase is a sign that the breeding season is approaching, and with migrating species there comes the accompanying instinct to migrate, and the bird begins its journey to the breeding ground. If there were no such thing as weather, and if food were always equally abundant, the bird would arrive at its nesting ground on exactly the same day each year. Indeed this is said to be the case with some of the sea birds, notably the puffins, which are little affected by the weather. They spend the greater part of the year at sea, but each year on exactly the same day they appear on their breeding islands.

The first birds to come in the spring, such as the robins and the blackbirds, are the least punctual, because in the early spring the weather is least settled. The later migrants become more and more punctual as the weather becomes more uniform until with those birds coming after the first of May we can prophesy the day of their arrival at any place with considerable accuracy.

Thus the record on page 46 of the spring migrants at Ithaca represents the average date of arrival of birds for ten years, and we can expect the birds to arrive each spring within a few days of the dates given. In other parts of New York State the dates would vary somewhat, particularly in the lower Hudson Valley and in the northern tier of counties, where the season is a week earlier and a week later respectively. By keeping a calendar in the school for a number of years, it will not be difficult to accumulate data for the commoner species, and thus establish a standard of comparison between that locality and Ithaca. If each teacher will send in a copy of the calendar kept in her school this year, we will publish next year a comparative table for the species that are most uniformly reported. Directions for keeping this migration table or calendar will be found at the end of this article.

If birds had no enemies and always hatched their first eggs successfully, it is probable that the fall migration would be as regular as the spring, because after the breeding season the reproductive organs begin to decrease in size just as they grew in the spring. But many birds have to make several attempts before they raise a brood successfully, and while they are still feeding their young in the nest, others of their species are ready to leave. Some species, however, wait for a second or even a third

brood, but the majority are ready after the first brood to enter once more upon a care-free existence. Some species, for example the swallows and the blackbirds, assemble in large, conspicuous flocks before migrating; but others slip away unnoticed, usually the old birds first, followed later by the young. It is the periodic changes in the reproductive organs, then, that tell birds when to migrate and the attendant instinct that impels them to go.

But this does not explain how and why birds came to migrate in the first place. It may explain how the instinct is maintained, but not how it has been developed. For this we have to resort to hypotheses. Without going into detail it may be interesting to review the one that receives greatest credence to-day. It is founded on two beliefs that we now look on almost as facts: first, the origin of bird life on this continent, and second, the coming of a glacial period, or ice age, when most of the birds were driven out.

In North America it is undoubtedly true that we have received our birds from two sources — from South America and from Asia by way of Alaska. We know this because some of our species are almost identical with those of Europe and Asia, while others are very similar to South American forms found nowhere else in the world. If we can imagine the South American birds, in ages past, gradually spreading northward because of an overcrowded condition or because of the natural instinct inherent in most organisms to cover as much territory as possible, we would find them eventually coming into a land which, while similar to that of their progenitors during a part of the year, was entirely different during winter and unsuited to their needs. They were, therefore, able to occupy it only during the summer months and each winter had to retire southward. This would have been sufficient eventually to form a migrating instinct of considerable power and regularity, but it does not explain all the variations in route and distance traveled, which we see to-day.

During the numerous geological ages that have ensued since birds first came into North America, the continent and the climate have seen great changes. North America has changed from a mild, semitropical land to one covered with snow and ice and back again to a land of decided seasons. If we think of birds as having become established during the semitropical times, even without any decided migrations, we can still think of them as developing this instinct to migrate under the stress of the slowly approaching ice stage, the birds being driven southward to seek quarters in already overcrowded tropics and striving northward with each returning spring and recession of the glaciers, only to be forced back again the following winter.

One might follow this thought in great detail and show how the various routes followed by birds between North and South America may have been evolved, but we cannot take space for it here. There remains one other problem, which seems even more mysterious, and that is, how birds find their way.

Each year the bobolink after traveling 10,000 miles comes back to the same meadow, and the oriole comes back to the same tree. The robin and the phœbe come back to their former nests and construct others close by or even on top of the old structures. What is it that guides them on their long journey and brings them back so precisely? It is instinct we now say, a sense which, not having ourselves, we are unable to understand. That sense which directs the carrier pigeon back to the home loft five days' journey distant, is probably the same that guides all birds on their migrations, and we call it a *sense of direction*. There have been numerous observations to support this theory. Some modern experiments on terns carried in the hold of a ship 1000 miles out of the range of the species, which, when released, flew back directly to their nests, have conclusively shown that birds do have this sense. But just what this sense is and what controls it, we have yet to learn.

DIRECTIONS FOR KEEPING A BIRD CALENDAR

The greatest value in keeping a bird calendar is in stimulating the boys and girls to greater powers of observation. The knowledge of birds gained from the little competition that always results is but a small part of the good derived from the awakened interest in nature, even though it does add a great resource to the lives of many. The stimulation that the children receive to be wide-awake to everything that is going on about them will stand by them in any walk of life. But inaccurate observation is worse than no observation, for great harm can come from it. Great care should be exercised by teachers, therefore, to verify the reports brought in by children so that no mistaken observations will appear on the chart. If there is any doubt as to the accuracy of a record, it should not be credited, for while it may give disappointment and even a little discouragement to some one child, it will be excellent training for him and will inspire all the others to observe more carefully. They will thus come to appreciate the chart more and more. If an atmosphere of accuracy is created about the school calendar, the study of the sciences later on will not be the bugbear that it is to some children.

In order to verify the first record, it is well to keep the second record, so that if too great discrepancy occurs between the first record and the average date of arrival, the second date can be retained instead.

The calendar should have at least five columns: the first for the name of the bird, the second for the date, the third for the locality where it was seen, the fourth for the name of the discoverer, and the last for the date of the second arrival.

A space devoted to recording the date the bird is last seen each year, might stimulate a little interest in the fall migration of birds, which usually passes unnoticed.

THE AVERAGE DATE OF THE SPRING ARRIVAL OF BIRDS AT ITHACA, NEW YORK

FEBRUARY 1 TO 21

Prairie horned lark

FEBRUARY 22 TO MARCH 15

Robin
Bluebird
Song sparrow
Canada goose
Red-winged blackbird
Bronzed grackle

MARCH 16 TO 25

Meadowlark
Killdeer
Black duck
Bufflehead
Baldpate
Pintail
Mallard
Wood duck
Phœbe
Cowbird
Cedar waxwing
Rusty blackbird
Slate-colored junco
Fox sparrow
Hooded merganser
Mourning dove
Ring-billed gull

MARCH 26 TO 31

Golden-crowned kinglet
Purple finch
Sparrow hawk
Savannah sparrow
Vesper sparrow
Cooper's hawk
Sharp-shinned hawk
Marsh hawk
Pied-billed grebe
Belted kingfisher
Great blue heron

APRIL 1 TO 5

Coot
Field sparrow
Chipping sparrow
Green-winged teal
Woodcock
Flicker
Yellow-bellied sapsucker
Swamp sparrow
Lesser scaup duck

APRIL 6 TO 10

Tree swallow
Blue-winged teal
Pectoral sandpiper
Pipit
Winter wren
Osprey
Bittern

APRIL 11 TO 15

Wilson's snipe
Red-breasted merganser
Hermit thrush

APRIL 16 TO 20

Goldfinch
Ruby-crowned kinglet
Louisiana water thrush
Barn swallow
Horned grebe
White-throated sparrow
Pine warbler

APRIL 21 TO 25

Myrtle warbler
Towhee

Spotted sandpiper
Chimney swift
Virginia rail
Bank swallow
Broad-winged hawk
Green heron

APRIL 26 TO 30

Rough-winged swallow
House wren
Brown thrasher
Blue-headed vireo
Black-and-white warbler
Yellow warbler
Veery
Solitary sandpiper
Black-throated green warbler
Florida gallinule
Bonaparte's gull
Water thrush
Whippoorwill
Sora
Pine siskin

MAY 1 TO 5

Redstart
Least flycatcher
Long-billed marsh wren
Lesser yellowlegs
Bartramian sandpiper
Parula warbler
Catbird
Grasshopper sparrow
Black-crowned night heron
Warbling vireo
Yellow-throated vireo
Nashville warbler
Maryland yellowthroat
Palm warbler
Ovenbird
Black-throated blue warbler
Blackburnian warbler
Baltimore oriole
White-crowned sparrow
Magnolia warbler
Crested flycatcher
Bobolink
Wood thrush
Scarlet tanager
Kingbird
Rose-breasted grosbeak
Red-headed woodpecker
Red-breasted nuthatch

MAY 6 TO 10

Chestnut-sided warbler
Worm-eating warbler
Red-eyed vireo
Olive-backed thrush
Canadian warbler
Least bittern
Greater yellowlegs
Purple martin
Ruby-throated hummingbird

MAY 11 TO 15

Mourning warbler
Wood pewee
Indigo bunting
Cape May warbler
Hooded warbler
Bay-breasted warbler
Cerulean warbler
Yellow-breasted chat
Philadelphia vireo
Wilson's warbler
Lincoln's sparrow
Tennessee warbler
Orange-crowned warbler
Black-billed cuckoo
Yellow-billed cuckoo
Black tern

MAY 16 TO 20

Orchard oriole
Alder flycatcher
Common tern
Least sandpiper
Red-backed sandpiper
Semipalmated sandpiper
Turnstone
Semipalmated plover
Nighthawk
Blackpoll warbler
Gray-cheeked thrush

MAY 21 TO 30

White-eyed vireo
Yellow-bellied flycatcher
Black-bellied plover
Prothonotary warbler

WHITE-BREASTED NUTHATCH

(For special study)

ANNA BOTSFORD COMSTOCK
Assistant Professor of Nature Study

A voice outside is calling me. I cannot describe it accurately, but it is making delightful woodsy remarks that make me long to throw aside the pen and go out and wander where the snow is making still softer the carpet of dead leaves on the forest floor. It is not a musical note, but it is most enticing and translates into sound the picture of bare-branched trees and the feeling of enchantment that permeates the forest in winter. Neltje Blanchan says that the voice reiterates, "hank, hank," others say it is "nay, nay"; but no nasal sound of the human voice and no spelling of the English language adequately represents this call of the white-breasted nuthatch.

On the tree in front of the window I can see the owner of this sylvan voice. It is flitting blithely from tree to tree enjoying the snowstorm and coming often to the suet feast that I have spread for him and his little feathered kin. The general color of the nuthatch is bluish gray above, with white breast, and reddish beneath the tail. The top of the head and the neck are glossy black; the sides of the head are white, as is the breast. The bill is blackish and so are the legs and feet. The wing feathers are dark brown edged with pale gray. The upper middle tail feathers are bluish, like the back; the others are dark brown and spotted with white in such a manner that when the tail is spread it has a large white patch on either side. The chickadee is gray in color, while the nuthatch is bluish gray; but the most striking difference is the black bib of the chickadee, which the nuthatch lacks entirely. The bill of the chickadee is short — "a sharply pointed little pick just suited to taking off insect eggs" — while the bill of the nuthatch is long and slender, being as long as, or longer than, the bird's head.

We have had exciting times at the suet banquet this morning. The building in which my office is, stands on a high knoll near the forest-covered brink of a deep gorge. Thus my window is opposite the tops of the trees. One of our nature-study staff, a brave and gallant knight, who loves birds and knows that I love to watch them, climbed two of these trees at imminent risk of breaking his neck in order to place this suet just opposite my window. The whole chickadee family, four nuthatches, and Sir Downy Woodpecker and Madam Hairy Woodpecker had been reveling in the feast all the morning when suddenly, one after another, three crows appeared on the scene. My heart sank as I saw them eying the suet with interest. Nearer and nearer they hopped from

branch to branch. I pounded on the window and called out, " Go away! " in both the crow and the English language, all in vain. One braver or hungrier than the others, with one defiant eye on me, flapped confidently

WHITE-BREASTED NUTHATCH
About one-half natural size

down and sought to carry the suet off in his beak; to his surprise it was tied on. That seemed suspicious, and when we raised the window and leaning far out explained matters, he lifted slowly with a jeering caw that said plainly, " I'll call sometime when you are not at home," and

he and his companions disappeared up the gorge. The invited guests at the suet table were less disturbed than was I, and I suppose it is rather inconsistent to feed the chickadees and let the crows go hungry. But this suet will last the little birds a month, while it would hardly furnish a breakfast for three crows; and in philanthropic enterprises one is obliged to draw the line somewhere even at the cost of consistency.

To return to my nuthatch — who has, by the way, just hammered off a piece of suet and thrust it into a crevice of the bark on the tree bole. Why does he do that? Is it for convenience in eating, or is it an attempt to store up some of his dinner for future need? Anyway, it is bad manners, like carrying off fruit from *table d'hôte*. But he is polite enough in another respect; every time after eating the suet he wipes his beak on his branch napkin with great assiduity, first one side and then the other, almost as if he were sharpening it. The woodpeckers are similarly fastidious in cleaning suet off their beaks.

The loud note of the nuthatch, which seems out of proportion to the size of the bird, is by no means its only note. Yesterday we observed a pair hunting on the branches of an elm over our heads, and they were talking to each other in sweet confidential syllables, "wit, wit, wit," entirely different from the loud note that is meant for the world at large.

The nuthatches and the chickadees usually hunt together, the chickadees ordinarily taking the smaller branches and the nuthatches the larger branches and tree trunks. The nuthatch is quite likely to alight head downward on a tree trunk, and it also often climbs the tree in a spiral route; it runs about over the tree so rapidly that it has been called the "tree mouse." Three characteristics distinguish this bird from the woodpeckers: it descends a tree trunk head first; its tail is short and square across the end and is never used as a brace; it has three toes directed forward, and one very long and strong one directed backward.

While the nuthatch is fond of acorns and nuts and the larvæ which are the "worms" in nuts, it is also fond of all kinds of insects and spends much time hunting for those that are hidden in the bark of trees. It is therefore a help to the farmer and the fruit grower by destroying so many injurious insects. It is comical to see a nuthatch take off a bit of suet, wedge it into a crevice in the bark, and then strike it with great force with its beak, apparently forgetting that it is not encased in a shell. It is fond of sunflower seeds also.

Although the nuthatch finds much of its food on trees, Mr. Torrey tells of seeing one awkwardly turning over the fallen leaves for hidden cocoons and other things quite worth his while; and Mr. Baskett tells of having seen these birds catch flies in the air and become quite out of breath at this unusual exercise.

Audubon made some most interesting observations on nuthatches. He says that they may sleep hanging with head downward. He also says, of their nesting habits, that "both birds work together, all the time congratulating each other in the tenderest manner. The male, ever conspicuous on such occasions, works some, and carries off the slender chips chiseled by the female. He struts around her, peeps into the hole, cherups at intervals, or hovers about her on the wing. While she is sitting on her eggs, he seldom absents himself many moments; now with a full bill he feeds her, now returns to be assured that her time is pleasantly spent." The nest is made of leaves, feathers, and the like, in a hole in a stump or a tree. There are from five to eight eggs, white, with reddish or lavender spots and speckles rather evenly distributed.

The red-breasted nuthatch is sometimes associated with its white-breasted cousin; it is a smaller bird and is essentially a northern species. The nuthatches get their name from their custom of wedging nuts and acorns into bark and then hammering or hatching them open with their strong bills. From every standpoint the nuthatches are most desirable acquaintances, and we cannot spend our time to better advantage than in becoming familiar with their interesting habits.

PHOTOGRAPH BY A. A. ALLEN

A WINDOW FEEDING STATION VISITED BY A NUTHATCH

About one-twelfth natural size

SUGGESTIONS FOR STUDY

The observations made by the pupils may be stimulated and guided by the teacher by the use of questions such as the following:

1. Describe the colors of the nuthatch as follows: general color above and below; color of top and sides of head; color of throat and breast; color of bill, legs, and feet; markings of wings and tail.

2. What are the differences in color between the nuthatch and the chickadee?

3. What is the difference in shape between the bill of the nuthatch and that of the chickadee?

4. Is the nuthatch seen most commonly on tree trunks or up in the smaller branches?

5. Does it alight on a tree trunk with head up or down?

6. When climbing, what kind of a route does it take? Does it use its tail as a brace when climbing a tree, as does the downy woodpecker?

7. When descending a tree does it ever go head downward? How does it compare in this respect with the downy woodpecker?

8. How are the nuthatch's toes arranged to enable it to cling to the trunk?

9. Has the nuthatch more than one note? If so, what are they?

10. What is the food of the nuthatch, and where is it found?

11. How does the nuthatch open an acorn?

12. Of what use is the nuthatch to the farmer and the fruit grower?

13. When does the nuthatch nest? Where is the nest made? What can be discovered about the habits of these birds at nesting time?

THE ECONOMIC IMPORTANCE OF THE WHITE-BREASTED NUTHATCH

H. D. Reed
Professor of Zoology, Cornell University

The white-breasted nuthatch is one of our most industrious gleaners of insects and their eggs and young from the trunks and branches of trees. An individual nuthatch hustling about his work, as frequently upside down as the reverse, is the very embodiment of industry and keen scrutiny. No crack nor cranny is too insignificant to escape inspection. The nuthatch does not dig holes in the trees in search of its food as do the woodpeckers, but rather gets it from the crevices in the rough bark. In such places millions of insects deposit their eggs for safe keeping during the winter months. The bill of the nuthatch is adapted through its shape to slip under the pieces of bark and to the very depths where eggs and, later, larvæ (" worms ") are to be found. It is impossible to estimate the millions of injurious insects destroyed by a single nuthatch during a year.

Among the injurious insects devoured by the nuthatch are: beetles, which bore in the bark or the wood; scale insects, among which is the oystershell bark louse, injurious to apples and pears; cankerworms; and the caterpillars of the gypsy moth. A single stomach of the nuthatch in one instance proved to contain 1629 eggs of the fall cankerworm. Granting that half of these eggs would produce females, which in turn would lay a large number of eggs, some idea can be gained of one day's service of this bird to man. There are other insects that would probably become pests were it not that they are held in check by the nuthatch.

During the winter months the nuthatch feeds to a large extent on the seeds of weeds, thus adding to its right to life and protection. There is

no doubt that this bird is to be considered the friend and colaborer of the forester, the fruit grower, and the farmer, and in return for its very efficient service it deserves encouragement and protection.

BIRDS TO BE RECOGNIZED IN 1917-1918

A. A. Allen and Elsa G. Allen

WINTER BIRDS

In the September 1916 leaflet a complete discussion of winter birds was given, with lists of all those that might be seen. Teachers should refer to this material in obtaining their own background of knowledge for the direction of winter bird study.

GOLDFINCH
About one-half natural size

ORIOLE

Material on the oriole has frequently been published and in order to economize space this year it has been omitted. Teachers should refer to page 32 of the September 1915 leaflet, where it last appeared.

GOLDFINCH

Size: Smaller than a sparrow.

General color: Male, top of head, wings, and tail black; remainder of body bright yellow. Female, olive-gray, wings and tail darker.

Sometimes in the midst of winter, a tiny form bounces over the snowy landscape uttering a whistled call of three or four descending notes. It is the goldfinch, which, on account of its seed-eating habits, is able to withstand the winters of the North. Goldfinches are great weed seed destroyers, and may be found along the borders of woods or even in the open fields where the dead weeds protrude their seed-laden tops above

the snow. Dandelions, burdocks, chickweed, and thistles are among their favorite weeds, but they feed also on the seeds of alder, birch, and hemlock trees. In fall, winter, and early spring, when goldfinches go about in flocks, they are frequently found associating with pine siskins and redpolls. They are very fond of sunflower seeds and may be attracted to feeding stations by this staple bird food. Every school and home garden should have a few sunflowers, for if the heads are allowed to mature their seeds, they will almost certainly attract many species of birds.

The goldfinch is more often thought of in this State, however, as a spring and summer bird. At this season the males wear their brilliant yellow and black plumage, which has given them the name of wild canary. The females are grayish olive with the wings and tail blackish, and in winter the males closely resemble the females. Sometimes the male goldfinch is confused with the yellow warbler, but it should be remembered that the goldfinch has black crown, wings, and tail.

PHOTOGRAPH BY A. A. ALLEN

FEMALE GOLDFINCH WITH NEST AND YOUNG
One-fourth natural size

The goldfinch has a number of calls, comparatively easy to learn, which remind one considerably of canary bird notes. While flying in its characteristic undulating manner, the goldfinch utters its *per-chick-a-ree* call with descending inflection. The alarm call, often given near the nest, resembles the syllables *bay-bee*, and the most canary-like of all its calls is the *tswee-tee*, usually given when the bird is at rest on a weed stalk or a fence. The song is a sweet varied warble.

Goldfinches, like waxwings, wait until July or August to build their nests. These are soft, cottony, cuplike structures lined with thistledown.

and are usually wider than high. They are placed toward the tip of a branch rather high up in fruit or shade trees, and the plain, bluish white eggs number three to six. Young goldfinches are fed by regurgitation.

PHŒBE

Size: About that of a sparrow.

General color: The general tone of the body is brown, grayish beneath, the head being darker.

Distinctive features: The phœbe possesses no striking characteristics. There are no white bars across the wings, which distinguishes it from the pewee. It may be identified in the field by its habit of bobbing the tail when perched.

PHŒBE
About one-third natural size

After the middle of March it is time to look for the phœbe, for unlike most flycatchers he winters in the southern United States, and is one of the first insect-eating birds to arrive in the spring. If there is a little warm weather to encourage him, he may begin to build his mossy nest or to remodel the old one, almost as soon as the female arrives, which is usually only a day or two later than the male. Back they will go to the old bridge or the roadside culvert, the shady cliff, or the ledge over the door of some dwelling, and if unmolested they will return year after year to the same place. Building the nest is often a prolonged, intermittent process with phœbes, and, if cold weather intervenes, it may be a couple of weeks or even a month before the eggs are laid.

The phœbe is the commonest of the flycatcher family. The head is rather large and square as with all the flycatchers, but the invariable field mark of the phœbe is his habit of bobbing his tail. He usually has a favorite exposed perch from which to dart at passing insects, and having captured one promptly flies back to his perch and pumps his tail as if to say, "There! I got you."

None of the flycatchers have true songs, although some, especially the pewee, have rather musical calls. The phœbe's call, however, is

merely a monotonous repetition of his own name *phœ-be, phœ-be*, and should not be confused with the spring song of the chickadee, which is a clear, sweet whistle of the same syllables. Sometimes the phœbe is inspired to sing on the wing, uttering *phœ-be* a dozen times as he flutters erratically through the air.

PHOTOGRAPH BY A. A. ALLEN

PHŒBE AT NEST ON A CLIFF
One-fourth natural size

Phœbes lay pure white eggs occasionally specked with black, and usually raise two broods of young in a season. The lice that commonly infest the nests of this species are sometimes so bad as to be objectionable if the nest is over a door of a house, and in such a case the nest and the young should be dusted with insect powder.

GRACKLE

Size: Larger than a robin.

General color: Black all over.

Distinctive features: The grackle walks like a crow. The absence of red shoulder patches distinguishes it at once from the red-winged blackbird. At close range it may be distinguished from the rusty blackbird by its larger size, wedge-shaped tail, and yellowish eyes, the eyes of the rusty blackbird being white.

The grackle is one of the family of blackbirds, as its common name, crow blackbird, suggests. It is a sleek, handsome bird somewhat larger than a robin, walking with dignified mien about lawns and parks and at a distance appears coal black, but on nearer view its plumage glints with bronze, greenish and purplish reflections chiefly on the head and the neck. There are two kinds of grackles, the bronzed and the purple, but it is difficult to distinguish them in the field. The purple grackle is common in the South, the lower Hudson Valley, and on Long Island, but the bronzed grackle is the only species in all other parts of New York

State. Grackles are easily recognized in the field by their long wedge-shaped tails, their yellow eyes, and their harsh strident notes.

Grackles are among the first birds to return in the spring, coming soon after the robins and the bluebirds. They likewise nest early, building rather large bulky nests of grasses with an inner layer of mud like the robin's. The grackle's nest may be distinguished from the robin's, however, by its larger inside measurement, which is over four inches. The eggs, numbering three to five, are bluish, variously marked with brown and black.

During the nesting season grackles feed largely on cutworms, beetles, caterpillars, grasshoppers, and similar insects, all of which may be serious pests in orchard and garden. Certain individual grackles, however,

PHOTOGRAPH BY A. A. ALLEN

MALE BRONZED GRACKLE WITH NEST AND YOUNG.
One-fifth natural size

are very destructive to the eggs and young of smaller birds, and therefore are not desirable to have where other birds are nesting. After the breeding season they congregate in large flocks and are often destructive to grain-fields, so that their reputation with farmers is not the best. But the good

that they do at other times of the year, by destroying pests of the fields, far overbalances their destructiveness to grain. At night grackles fly to roost in the marshes or in tall hemlocks and while settling there keep up a discordant din loud enough to disturb a whole neighborhood.

BRONZED GRACKLE, OR CROW BLACKBIRD
About one-third natural size

Migrating grackles fly in long files, which readily distinguish them from other species of blackbirds, which travel in more scattered flocks. They remain with us until the middle of November but retire to the southern United States for the winter.

BROWN THRASHER

Size: About the size of a robin but with longer tail.

General color: Upper parts, wings, and tail reddish brown. Wing coverts tipped with whitish. Under parts white, streaked with black except on throat and middle of belly.

Distinctive features: The brown thrasher flirts his tail much as the catbird does. He can be distinguished from the thrushes similar in color by the two white wing bars and the long tail.

This fine bird, although rather uncommon in some parts of New York State, should be easy to recognize, for no other bird has the long, slender

body and the rich brown plumage, with heavily streaked breast, that distinguish the brown thrasher.

The brown thrasher resembles the catbird in habits, frequenting thickets and underbrush on dry hillsides usually removed from habitations. It is less friendly toward man than the catbird, but the ways of the two birds are considerably alike, for they are closely related.

The nest of the thrasher is placed on or near the ground in a tangle of thick-growing bushes and vines, fashioned of twigs, straws, leaves, and coarse rootlets. The four eggs are rather long and slender, and are whitish heavily speckled with brown.

The call of the thrasher is a loud, sharp *tsac* and is usually all that is heard on the migration, but during the nesting season the males sing beautifully, often for fifteen or twenty minutes from the top of a tree. The song resembles the catbird's but is louder and free from *meows*.

During the spring and summer thrashers are ground-loving, feeding

BROWN THRASHER
About one-third natural size

on worms, insects, and pupæ found under leaves and brush, but later in the season they take wild fruits. For this reason, probably, thrashers do not perform a long migration to the tropics, but spend the winter from North Carolina and Missouri to Florida and Texas.

MEADOWLARK

Size: Larger than the robin, but with shorter tail.

General color: Brown streaked with black above; bright yellow beneath.

Distinctive features: A black crescent on the breast; the outer tail feathers, which show when spread in flight, are white.

When the meadowlark's liquid notes ring clear through the open country, we feel that spring has come. The meadowlark usually sings from a fence post or a lonely tree in the midst of a large field, whence its loud, plaintive song carries to the whole countryside, for it belongs primarily to the fields

PHOTOGRAPH BY A. A. ALLEN

DOMED NEST OF THE MEADOWLARK IN A HAYFIELD
One-fourth natural size

and the meadows. There, right on the ground, it builds its arched-over nest, which is so inconspicuous that one may step on it without seeing the speckled eggs or the grayish, helpless young. Many nests are destroyed by early mowing in New York State.

The meadowlark is a bird that every teacher and school child should know, and one that all may easily learn, for it is abundant throughout the State. In spite of its conspicuous coloring it is one of the blackbirds, having the characteristic bill and sloping profile of this family. The meadowlark sails over the fields, a good deal after the manner of a bob-white, and utters a guttural chatter somewhat harsh, but not unpleasant, a

MEADOWLARK
About one-third natural size

sound that belongs to the open country as much as does its musical whistle. It has also several sharp call notes.

In spring and summer meadowlarks feed almost entirely on crickets, grasshoppers, beetles, white grubs, and other destructive insects, and are thus of great help to the farmer.

Meadowlarks winter in the Southern States, where formerly they were shot in large numbers for the market. Now, however, they are protected by federal law, and a heavy fine is imposed on any one shooting them.

CLIFF SWALLOW

Size: About the same as a sparrow.

General color: Blue above, buffy beneath.

Distinctive features: A white band across the forehead, a rich chestnut patch on the throat, and a buffy patch above the tail. The tail is not deeply forked like that of the barn swallow.

The swallows divide readily into the blue and the brown group. The barn, tree, and cliff swallows and the purple martin are blue; the bank and rough-winged swallows are brown.

The cliff swallow, or eave swallow as it is often called, nests in colonies under the eaves of barns and other buildings, making gourd- or jug-shaped nests of mud and grass. It is distributed rather unevenly in New York State, and in some parts has been so persecuted and driven from its nesting grounds by thoughtless farmers that it is largely exterminated. Swallows are very interesting and beneficial birds to have about, destroying, as they do, great quantities of insects, which they catch on the wing. Swallows

CLIFF SWALLOW
About one-third natural size

should be protected and encouraged in every way. When permitted, fifty to one hundred pairs will hang their nests to the same barn, and when we consider that each one contains four to six hungry young, we may easily believe that the colony is ridding the neighborhood of millions of insects.

The cliff swallow returns from its winter home in central and northern South America about the fifteenth of April and remains in New York State as a summer resident until the fifteenth of September. Soon after the nesting season the swallows gather in large flocks and may be seen in lines of hundreds resting on telegraph wires about marshes. All swallows at such times associate together and offer an excellent opportunity to the bird student to learn the various species. This flocking of the swallows in July and August is the first sign of the fall migration, foreshadowing in the midst of summer the winter to come.

BLACK-AND-WHITE WARBLER
About one-half natural size

BLACK-AND-WHITE WARBLER

Size: Smaller than a sparrow.

General color: Streaked all over with black and white except on the middle of the breast. A decided white streak on the top of the head.

The black-and-white warbler is often called the black-and-white creeper because it climbs about the trunks and branches of trees somewhat as does the brown creeper. Its method of climbing differs from the brown creeper's, however, in that the tail is not employed as a prop. It reminds one more of a nuthatch, but it is really a warbler having the peculiar habit of creeping and climbing more strongly developed than the other warblers. It goes right side up and upside down with equal facility, peering into every crevice for insects and their eggs, and is one of the most restless members of its restless family.

The black-and-white warbler is one of the earlier warblers to return in the spring, appearing in New York State usually between the twentieth and the thirtieth of April. Many of these warblers go farther north to nest, reaching Nova Scotia and Newfoundland, but many pairs stay in various parts of the State for the summer. On the migration they appear even along city streets, but for nesting they prefer open woodlands with plenty of tangled underbrush. The nest is built on or near the ground

under a mossy log or the edge of a rock, or among the roots of an old stump, and the eggs, numbering four or five, are white spotted with reddish brown and lilac chiefly about the larger end.

The song of the black-and-white warbler is at best but a thin little refrain. On the migration one usually hears only the sharp, hissing notes, which can be imitated by inhaling and exhaling through the closed teeth, but on its breeding grounds it has a longer and quite different song.

In August and September this species becomes much more numerous, owing to the influx of migrants from the North. A few black-and-white warblers winter in southern Florida, the Bahamas, and the West Indies, but the majority go to Central America and northern South America.

BALD EAGLE

Size: Larger than the domestic hen.

General color: Head, neck, and tail white; remainder of body dark brown.

It is not uncommon to see this noble bird, the bald eagle, about the Great Lakes, the Finger Lakes, the Adirondacks, and the larger rivers, but its numbers have been considerably thinned by hunters and egg collectors in spite of protecting laws.

The bald eagle was the largest native bird known to our forefathers and therefore was chosen for our national emblem. Some have objected to it on the ground that it is a scavenger, but in point of fierceness and elegance of plumage it is the finest bird we have. The adults have the head, the neck, and the tail snowy white, and the rest of the plumage brownish black. On account of the white head and tail, adult bald eagles can be recognized a long way off, but the immature birds, which do not have their full plumage for three or four years, are rather difficult to distinguish, for they are brownish black with only a few whitish spots on the under parts and the tail, depending on their age.

Eagles frequent lakes and rivers mostly, for fish is their favorite food, but often, when fish is scarce, they descend to such offal as dead animals in the field, or they may rob the fish hawk of his booty. Sometimes, especially in winter, they take dead and wounded ducks on the lakes and the rivers, but they have difficulty in capturing the diving species, such as scaups and canvasbacks.

Eagles nest very early in the spring, in February or early March, selecting a lofty tree in a lonely woods or swamp. The nest is placed near the top of the tree, and is a bulky conspicuous structure made of coarse sticks.

Two or three dull white eggs without spots or marks of any kind are laid. They are larger than the eggs of a domestic duck, measuring nearly three inches in length. Like the young of hawks and owls, eagles when

BALD EAGLE
About one-tenth natural size

first hatched are covered with whitish down. It requires four weeks for the eggs to hatch and about four months for the young to acquire their brown feathers and to be able to fly so that, in spite of the fact that the eggs are laid in February or March, the young are not ready to leave the nest until the last of July or the first of August.

PEACOCK

Size: Larger than the domestic hen, the tail much longer than the rest of the body.

General color: Prevailing colors iridescent blues and greens. Broad ends of tail feathers with conspicuous spots margined with gold.

The peacock is the male of the peafowl.

We must look to zoological gardens and private estates to see this gorgeous bird, but even in domestication it retains much of its native wildness. Peacocks, which are related to the pheasants and other fowl-like birds, are native of India and Ceylon, but in ancient times were introduced into Palestine, Greece, and Rome. Since then they have been carried almost all over the world.

They are larger than the domestic fowl, in fact are more nearly the size of the turkey. The males are brilliant iridescent blue and have the long showy trains for which they have always been famous. This train is in reality not the tail, as is commonly supposed, but is made up of the feathers above the tail, or the tail coverts, excessively elongated. The females are much duller and lack the trains, but both sexes have the head adorned with a little tuft of quills, naked at the base, and fanlike at the extremities.

In the wild state peacocks are polygamous, consorting with four or five females in the breeding season. Peafowls like wooded mountain slopes with plenty of thick cover; for they are extremely shy. They are practically omnivorous, feeding on fruits, seeds, insects, snails, lizards, and small frogs. In India, where they are very abundant, they are somewhat destructive to grain crops and young plantations. In its native home, the peacock is held sacred by many Indian castes and is carefully protected. This probably accounts for its destructiveness, for none are ever killed.

To the Greeks and the Romans the peacock was the favorite bird of Juno, and to the early Christians it was emblematic of a glorified body. The eyed train feathers have long been used as ornaments, and in the Middle Ages the flesh of the bird was considered a great delicacy and appeared on the table garnished with its own gorgeous plumage. The Romans in their decadent civilization are said to have served the tongues and the brains of peacocks as an entrée.

BIRD QUOTATIONS

COMPANIONSHIP

The little Hiawatha
Learned of every bird its language,
Learned their names and all their secrets,
How they built their nests in summer,
Where they hid themselves in winter,
Talked with them whene'er he met them,
Called them Hiawatha's Chickens.

From *The Song of Hiawatha*
by HENRY WADSWORTH LONGFELLOW

PROTECTION

I've plucked the berry from the bush, the brown nut from the tree,
But heart of happy little bird ne'er broken was by me.
I saw them in their curious nests, close crouching, slyly peer
With their wild eyes, like glittering beads, to note if harm were near;
I passed them by, and blessed them all; I felt that it was good
To leave unmoved the creatures small whose home was in the wood.

From *Sing On, Blithe Bird!*
by WILLIAM MOTHERWELL

MIGRATION

'Tis the sweetest thing to remember
If courage be on the wane,
When the cold dark days are over —
Why, the birds go North again.

From *When the Birds Go North Again*
by ELLA HIGGINSON

NUTHATCH

The busy nuthatch climbs his tree,
Around the great bole spirally,
Peeping into wrinkles gray,
Under ruffled lichens gay,
Lazily piping one sharp note
From his silver mailéd throat.

By MAURICE THOMPSON

ORIOLE

My oriole, my glance of summer fire,
Is come at last, and ever on the watch,
Twitches the pack-thread I had lightly wound
About the bough to help his housekeeping,—
Twitches and scouts by turns, blessing his luck,
Yet fearing me who laid it in his way,
Nor, more than wiser we in our affairs,
Divines the providence that hides and helps.
Heave, ho! heave, ho! he whistles as the twine
Slackens its hold; once more, now: and a flash
Lightens across the sunlight to the elm
Where his mate dangles at her cup of felt.

From *Under the Willows*
by JAMES RUSSELL LOWELL

GOLDFINCH

Down from the sky on a sudden he drops
Into the mullen and juniper-tops,
Flushed from his bath in the midsummer shine
Flooding the meadow-land, drunk with the wine
Spilled from the urns of the blue, like a bold
Sky-buccaneer in his sable and gold.

From *The Goldfinch*
by ODELL SHEPARD

PHŒBE

When buckets shine 'gainst maple trees
  And drop by drop the sap doth flow,
When days are warm, but nights do freeze,
  And deep in woods lie drifts of snow,
When cattle low and fret in stall,
The morning brings the phœbe's call
" Phœbe,
Phœbe, phœbe," a cheery note
While cackling hens make such a rout.

By JOHN BURROUGHS

BROWN THRASHER

There's a merry brown thrush sitting up in a tree,
He's singing to me! He's singing to me!
And what does he say, little girl, little boy?
" Oh, the world's running over with joy!
Don't you hear? Don't you see?
Hush! Look! In my tree
I'm as happy, as happy can be!"

From *The Brown Thrush*
by LUCY LARCOM

MEADOW LARK

Sweet, sweet, sweet! O happy that I am!
(Listen to the meadow-larks, across the fields that sing!)
Sweet, sweet, sweet! O subtle breath of balm,
O winds that blow, O buds that grow, O rapture of the spring!

* * * * * * * * * * * * *

Sweet, sweet, sweet! Who prates of care and pain?
Who says that life is sorrowful? O life so glad, so fleet!
Ah! he who lives the noblest life finds life the noblest gain,
The tears of pain a tender rain to make its waters sweet.

From *Meadow-Larks*
by INA COOLBRITH

POULTRY STUDY

THE EDITOR

The study of the hen and all that it involves, has been deemed important enough to be included in the Syllabus every year. It is not possible to republish each year the material that has already been presented in the leaflet. The poultry work was last published in the September 1915 number, and teachers who do not have access to that leaflet may obtain a copy by writing to the Editor, Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York.

The poultry study should not be neglected or overlooked, for it is one of the most interesting and valuable phases of the work in nature study.

CHILDREN OFTEN ASSUME CHARGE OF THE HOME FLOCKS

There are a great many ways in which it can be approached, and the subject is one that can be adapted to every season. The following are a few brief suggestions that may help teachers to discover the particular method of introducing poultry study that best fits their conditions.

1. A hen, a chicken, a duck, or other individual of the poultry world may be brought to the schoolhouse for a day and studied. This has been done by many schools with the greatest success.

2. A survey of the poultry interests of the community may be made. Thanksgiving time offers one of the best opportunities for this. In their investigations the children should consider such points as: (1) number of flocks; (2) size of flocks; (3) kinds of poultry, breeds and varieties; (4) care of poultry, housing, feeding; (5) how the products are used or marketed; and many other questions.

3. A successful poultry man or woman may be persuaded to come to the school and present to the children some phase of the work. A most

instructive lesson of this kind can be centered around the selection of eggs for hatching if the visitor will bring a basket of eggs.

4. A trip to a poultry farm, if carefully planned and conducted with spirit and earnestness, will result in much real development for the children. If more than one farm can be visited during the year, there is added value in the opportunity to compare various methods.

5. In the spring a flock of chickens may be raised at the schoolhouse by setting a hen in the woodshed or some place where conditions will be right. Many schools have tried this plan, and the teaching value it possesses cannot be overestimated. It should be carefully thought out in order that the chances of failure will be minimized.

6. Various mounts and charts and notebooks may be prepared in relation to poultry (pages 306 and 307). In all such work, however, effort should be made to keep it in touch as closely as possible with the actual material.

7. The children should be encouraged to participate in poultry contests and exhibits that may be organized by the district superintendent.

Of course the interest taken in poultry at the school should result in some of the children's assuming care of a flock at home, or, if they already have such a responsibility, in helping them to improve their methods. One teacher had the following to say in this connection:

One winter all the pupils except three small boys moved from the district. I expected stagnation, and that they would dread to come at all. Those weeks we studied poultry. Recesses and noons together we sawed and hammered away at dry-goods boxes until they became feed hoppers of various kinds. The boys obtained permission to take entire care of a flock of hens at home through the winter, following as nearly as they could the directions in the leaflet. They made egg records and were very enthusiastic over their gains. One, at least, has kept a flock of hens ever since. Besides, their other school work was improved because of their enthusiasm.

A remarkably fine piece of work is described in the following extract from a teacher's letter. The attitude toward the use of outlines is particularly good. Outlines are of great value when they fit the conditions. They can only fit the conditions when they are created for the occasion, and in the place where there is need of them. This means that no two will be exactly alike even though they may cover the same fundamental principles. The mere fact that the teacher prepares the outline that is to be used means that there has been more and better first-hand preparation to guide the children in their study. The outline used by the teacher whose report follows, is printed as suggestive of a right attitude and the result that came of it, and must not be accepted by other teachers as suited to their conditions, as complete in all details, or as a substitute for their own creative thought.

To-day has been one of the most profitable days in school we have had this year. During the noon hour and a part of the hour following, we made a trip to a neighbor's. She has splendid success with her poultry, and since her building and methods of care

are very good indeed we were anxious to study with her. I am sending an outline as filled out by one of the boys. Of course, all the children old enough had outlines to fill in, while in a few cases two persons filled out the same one. The interest shown by the pupils was very marked. Later I may send you a picture of the group in front of the poultry house if the one I took turns out well. A neighbor teacher rides nearly to her school with me each morning, and I gave her an invitation to go with us. This teacher knows very little of country life teaching so was more than glad of the opportunity even though she had but four pupils to bring. I wish to ask concerning the use of these outlines. Of course I don't approve of set outlines in nature study work; yet it seemed as I was planning the trip that an outline of the observations we were to make would be very helpful on the trip and later when comparing with similar trips if some of the children can visit a few other houses by themselves and report. I found that their interest was keener and that they seemed to enjoy making note of the observations. It took me at least two hours to make out the outline and duplicate it, but I feel repaid for the work.

While at this farm we visited the cow stables and noted especially the ventilation system, which the owner built himself.

Record of a trip made to inspect the winter quarters of a flock of poultry, January 8, 1917, by an eighth grade boy:

Kind of fowls:.................................... S. C. White Leghorns

Pen:
1. Size.. 60 x 18 feet
2. Number of fowls.................................. 230
3. Front faces...................................... South
4. House protected.................................. Yes
5. On dry ground.................................... Yes

Fresh air and sunlight:
1. Windows:
   (a) Size...................................... 10 x 30 inches, 2 panes
   (b) Where..................................... South side
   (c) Number.................................... 10
2. How ventilated.................................. Pipe with openings behind each dropping board

Warmth:
1. Height of roof:
   (a) Front..................................... 10 feet
   (b) Back...................................... 5 feet
2. Walls.. Double boarded

Dryness:
Floor covered....................................... Yes

Roosts:
1. Perches:
   (a) Material.................................. Two-by-fours
   (b) How placed................................ Level
2. Height above floor............................... 2½ feet

Nests:
1. Number... 30
2. In keeping with the bird nature.................. Yes
3. Height... 1 foot, 2½ feet, 4 feet
4. Opening.. Dark side
5. Interior... Clean straw

Freedom:.. Not allowed outdoors in winter, but they have a large dust bath and scratching pen

Cleanliness:
1. What litter on floor............................. Clean straw
2. Is it dry?....................................... Yes
3. Dust bath.. Yes, on a large space
4. Walls whitewashed................................ Around roosts
5. Other methods for keeping lice in check.......... No spraying except in summer

Feeding:	
Morning feed:	
1. Kind	½ whole wheat; ½ cracked corn
2. Amount	8 quarts for 100 fowls, scant
3. How fed and when	8 o'clock, in litter
4. Water	In pail above floor. Clean
Noon feed:	
1. Kind	Cornell ration, dry, in front of them all the time
2. Amount compared with morning	
3. Green stuff	Yes, cabbage
4. Oyster shell	Yes
5. Grit	Yes
6. Charcoal	In noon feed
Night feed:	
1. Kind	Same as morning
2. Amount compared with morning	More
Do hens or pullets lay better?	Pullets laying better now
Do they have the same care?	Yes
Discuss condition of fowls	

It may be well to point out that poultry study is not by any means confined to rural districts. In fact villages and smaller cities offer many opportunities connected with the small flocks that are kept by numerous householders. Even the large cities may reveal unsuspected facilities once interest is aroused, and wherever a poultry show is held a means of education is offered that should not be neglected.

A FINE PAIR OF WHITE PLYMOUTH ROCKS OWNED BY A SCHOOLBOY

ANIMAL STUDY

THE EDITOR

THE Syllabus calls for a special study of the cat and the cow during the coming year. Teachers are familiar with the fact that the cow is given for special study each year, particularly in grades four to eight, although there is no reason why the younger children should not be interested in some phases of the work. Because of the many considerations involved in each of these two topics, special notes have been given on them in connection with the material presented (pages 76 and 79).

The list of animals for recognition includes: goat, fox, skunk, muskrat, and frog. It will be difficult in some cases to have real contact with these animals, but unless this can be brought about a great deal of time should not be devoted to their study, inasmuch as textbook work involves loss of interest and is not in keeping with the spirit of nature study at its best. It is more than possible, however, that in many schools occasions will arise during the year when there will be opportunity to study these animals, and such occasions should be made use of promptly and to the best advantage.

The goat will, perhaps, be fully as available to city schools as to those in the country, for it is not uncommon to find goats on the outskirts of urban centers. After the children become interested in a real goat, they should continue their reading and investigation regarding goats of other lands, for all of this information will relate to their experience with the goat that they know.

Foxes are often killed or captured in country districts, and if a teacher should learn that one is accessible, effort should be made to study the appearance and the habits of the animal as far as possible. The question of the maintenance of wild animals in captivity should be touched on in this connection, and it should be pointed out that it should not be done for any length of time except in the case of those animals that are kept in permanent captivity in the zoos and public parks. Teachers in cities have abundant opportunity through the zoos to come in touch with most of the wild animals, but should endeavor to help the children to

gain some conception of their existence in the wild state as opposed to their present captivity.

Many boys are in the habit of trapping, and two of the animals that they often catch are the skunk and the muskrat. Thus there will probably be opportunity to study these animals first-hand some time during the season. A visit should be made to a muskrat house if there is one in the vicinity, and the interesting dome-shaped structure and the habits of the muskrats can then be studied. In the case of each of the animals on the list attention should be drawn to their economic value or to the harm that they do.

Frogs are usually more available for study, and can be kept for a time in the schoolroom in an aquarium. They are interesting creatures, and the different species are worthy of contrast. Likewise, the development of the frog from the egg to the adult is perfectly possible of observation right in the aquarium.

Thus, as is usually the case, one is surprised at the possibilities that are involved in a list of topics that at first sight appears somewhat unpromising. The study of animals is fascinating, and children can always be counted on to respond if the work is really vital, as it should be. In speaking of the work in her school one teacher had the following to say in regard to animal study:

> All the phases of nature study are helpful and interesting, and it is hard to decide which is more so than another. I think that the farmers appreciate it more when their children study seed testing, weeds, and care of cows and horses and poultry. The rest of the work seems like "tommyrot" to them, but they are beginning to see the other side of the matter. In studying care of stock, we make charts of different feeds used, study briefly the anatomy and the diseases of stock, and learn all about the balanced ration and milk testing. I take the children to model cow stables and poultry coops, and we study construction, sanitation, and the like. The children draw plans of barns, and we have made models from old boxes. I lay especial emphasis on light and ventilation. When we get back to the schoolhouse after one of these visits, the children discuss the barn from all points of view.

This brings up the opportunity in studying domestic animals to prepare feed mounts and product mounts, such as are suggested on page 307.

In preparing for the animal study work teachers are urged to read over the technical material on the different topics, and to make notes of any suggestions that appeal as being of especial interest or adaptability to the community. Opportunity will probably present itself very early in the year for some contact with animals. The first interest need not necessarily be in any one of those in the Syllabus list for this year. Once the children are awake to the possibilities involved in an intelligent study of animal life, they will readily respond to suggestions that the teacher makes as a result of her background of knowledge, and her chief task then is to guide the work and to keep it progressive and wholesome.

CAT

(For special study)

It is difficult to know just what point of view to give in regard to the study of the cat. It would seem, however, that time in the schools might be spent to much better advantage in giving instruction that relates to other forms of animal life. Most persons are familiar with the habits and the characteristics of the cat, and while something of value may come from directed study and observation teachers should not devote too much time to this topic.

It is very essential that a right attitude toward the cat should prevail. However much any individual may care for a cat, he will doubtless be open-minded enough to help in working out a problem that is of deep interest at the present time. Altogether too many cats are at large, free to wander in all kinds of places, to destroy useful forms of life, and to carry filth and disease. Many persons who make pets of cats feel that there are too many and that the freedom allowed them is serious in its effect on public welfare.

Nowhere can a point of view in this matter be created more effectively and quickly than in the schools. Children as a rule love cats, but they are also coming more and more to love birds and to appreciate the value that the latter have to man. They can easily be led to see that the number of cats must be limited, that the activities of those that grow up must be controlled, and that sentiment must not be permitted to outweigh common sense in our attitude towards the cat. It is clear that the cat question is fully as important or even more important in cities than it is in the country, for it is from the cities that so many cats ultimately reach the country. A special opportunity therefore rests in the hands of the urban teacher.

During the last session of the Legislature a bill was introduced providing for the licensing of cats. It passed the Senate, but was never reported out of committee in the Assembly. It is undoubtedly only a question of time before such legislation will become law, but the time will be hastened in proportion as more persons come to realize the wisdom and necessity of the movement. Surely any one who truly cares for a cat should be willing to register and license it, and in this way to safeguard the public.

In discussing these various questions with the pupils, teachers will find the following extract of great value in providing a background of knowledge. It is taken from a very complete and comprehensive bulletin on *The Domestic Cat*, issued by the State Board of Agriculture of Massachusetts and prepared by Dr. Edward Howe Forbush. The paragraphs

quoted represent the summary and conclusions of the whole bulletin and apply no less to New York than to New England.

The cat was domesticated within historic times, but did not appear as an inmate of the home in Western Europe until about 900 A. D. Civilized man managed very well without it for centuries. Puss appears to have been domesticated first in Egypt about 1200 to 1600 B. C. by the taming of certain wild African species.

The household pets of to-day are believed to have descended from African, Asiatic and European species.

The cat is far more widely kept and distributed than any other domestic animal, and is under less control and restraint than any other. It usually has a greater affection for places than for persons, and tends to return to its home when its owner moves away. Also, it readily abandons its owner, and, often abandoned by him, returns to the wild. Incalculable numbers of wild or stray house cats now roam the woods and fields of New England. These wild cats attract others from their homes.

Many, remaining with the owners, are fed insufficiently or not at all, and having to rely on their own efforts for food, emulate those that have run wild. Many pet cats are allowed to roam the country at night. People keep too many cats, and as the population increases the number of cats increases accordingly.

The cat, an introduced animal, is not needed here outside of buildings. It has disturbed the biological balance and has become a destructive force among native birds and mammals. It is a member of one of the most bloodthirsty and carnivorous families of the mammalia, and makes terrific inroads on weaker creatures. It is particularly destructive to certain insect-eating forms of life, such as birds, moles, shrews, toads, etc. Every year the cats of New England undoubtedly destroy millions of birds and other useful creatures, therefore indirectly aiding the increase of insects which destroy crops and trees. Such insects possibly cost the people of Massachusetts from seven and one-half million to nine million dollars annually. The cat protects them, thus increasing the cost of living to every citizen. The good that cats accomplish in the destruction of field mice, woods mice, and insects is of little consequence beside the ravages that they inflict among insectivorous birds and other insect-eating and mouse-eating creatures.

Cats, selected for their rat-killing propensities, are useful if kept in their proper place in and around buildings, but the species is so destructive to game and to valuable wild life that it should not be allowed to roam, particularly in the country. City cats should not be taken to the country in the summer and there permitted to run at large, to prey on birds and game, nor should they be abandoned and left to their own devices at the close of the season. This is both cruel and unlawful.

Many people do not keep cats. Rats and mice are disposed of by ratproofing buildings and food receptacles and using traps. The utility of the cat in destroying rats and mice has been both overrated and understated. The testimony of cat lovers and cat owners, taken during a canvass in several counties of Massachusetts, seems to indicate that only about one-third of the cats kept in the country towns are known to catch rats, and that only about one-fifth of them are efficient ratters. The number of mousers is large, but mice may be readily disposed of by traps. It is probable that one-fifth of the cats kept in the country, properly selected and restrained, would accomplish as much in killing rats and mice as do those now kept, and possibly the requisite number might be still further reduced by careful selection and breeding.

Apparently the cat has few legal rights. In most countries the law seems to regard it as a predatory animal, which any person may destroy when found doing damage on his premises. In Massachusetts and some other States the laws protect it from cruelty and abuse. People killing cats should observe all laws or ordinances in regard to trespassing, cruelty, shooting, trapping or poisoning. A cat apparently has some rights on the property of its owner that are denied it when on the property of others.

There are laws to protect insectivorous birds against gunners, snarers and trappers. Birds of prey and wild predatory animals are proscribed by law, and bounties are offered on the heads of some. Many States offer bounties for native wild cats, but there is no law to check the ravages of the wild house cat,— a far more numerous animal. A man may be fined $10 for killing a songbird, but he may keep any number of cats and may train them to kill many birds weekly. Hardly a hand is raised to stay the destruction of valuable wild life by hundreds of thousands of vagabond or wild house cats. Hunters and trappers have little incentive to kill them as the fur is of small value. Legislation is needed to check this evil.

It is undeniable that cats may carry such infections as smallpox and scarlet fever but the subject requires careful investigation before exact statements can be made. The evidence thus far offered is inconclusive. Cats undoubtedly disseminate ringworm, and rabies in the cat is more dangerous to man than in the dog, but rarer. In some cases serious infections appear to have been transmitted by the bites or scratches of cats, but here again the evidence of direct infection is not conclusive, as any wound may become infected after infliction.

The evils connected with the unrestrained liberty of the cat can be abated only by reducing the number of cats to a minimum, limiting breeding, destroying superfluous kittens at birth, restraining or confining cats kept as pets and as ratters (particularly at night and during the breeding season of the birds), quarantining cats in cases of infectious diseases, and destroying all stray and feral cats, wherever they may be found.

When it becomes necessary to allow barn cats free range, that they may destroy rats outside of buildings during the summer months, they should be supplied with water and well and regularly fed with mcat and other animal foods. Probably in most cases they will then be less likely to roam the fields and more inclined to lie in wait for rats and mice than if not well fed.

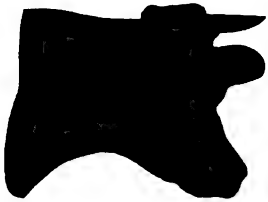
In dealing with the cat from an economic point of view we need raise no question of the rights of the animal. Man has won his way upward through the great struggle by his own powers of mind out of prehistoric darkness to the place of command. He now controls the destinies of his fellow creatures. He may concede them certain rights only if such concession does not interfere with the best interests of all.

Animals were domesticated because of their utility to man in his struggle upward from savagery. The sympathy which he feels for his helpers and pets, praiseworthy and important as it is, is a secondary consideration. The claims of the cat to a place in our domestic life rest primarily on the fact that it is supposed to do for us, with little conscious effort on our part, the onerous, petty and disagreeable task of destroying small rodents which for centuries have elected to fasten themselves as parasites on civilization. Insomuch as the creature fails in this, in so far as it destroys other more useful or nobler forms of life, in such measure it becomes an evil and a pest. It will become an influence for good or ill according as we mould it, restrain it and limit its activities. It is our duty to check, with a firm hand, its undue increase in domestication, and to eliminate the vagrant or feral cat as we would a wolf.

A FAMILIAR SCENE IN NEW YORK STATE

COW

(For special study)



INASMUCH as the study of the cow is called for each year by the State Syllabus, it is not possible to republish all the material on the subject annually. Yet this is one of the most important and interesting topics that is available for study, and something should be done with it every year by practically all schools.

Teachers who do not have access to a copy of the September 1915 leaflet should obtain one by writing to the Editor, Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York. That number contains lessons on cows entitled:

1. A study of cows
2. Rumination in cattle
3. Food and care of cows
4. The calf
5. The distribution of cows
6. The beef type and the dairy type
7. The color of cows
8. Scoring and judging dairy cows
9. The Babcock test for butterfat in milk

It was felt desirable this year to present material that would treat more largely of cattle products, and articles will be found on the following pages dealing with:

1. Keeping dairy herd records
2. Handling milk
3. Grades of milk
4. Milk and its constituents
5. Butter
6. Beef

Teachers who will read carefully the material presented in relation to cow study will hardly need to have pointed out to them the many possibilities for work through the school. For example, the following suggestions grow out of the articles given in this leaflet: (1) One or more pupils may keep a herd record, and all would profit by the manipulation of the Babcock test * and by the demonstration of the value of knowing

*A complete and helpful discussion of the Babcock test is contained in Reading Course for the Farm, Lesson 118, which may be obtained free on application to the Office of Publication, New York State College of Agriculture, Ithaca, New York.

what cows produce. (2) The various simple experiments in relation to the handling of milk may be made. (3) A milk station may be visited and something learned about the grades of milk. (4) The fascinating experiment of separating out the various constituents of a quart of milk and actually seeing their quantity and quality may be performed. (5) Butter may be made at school or at home, or a visit may be paid to a creamery. (6) A study may be made of meat cuts, their preservation and their uses, either with the live animal, or on a carcass at a home farm or in a butcher shop. This last should be of special interest to the girls who, as housewives, will have much responsibility in the wise selection, care, and use of meat.

The constituents of milk, butter making, and beef may be studied almost as readily in cities as in the country, and should a Babcock tester be available, that can be used also.

New York is a dairy State. Cows and all that relates to them are important factors in our lives. The wealth of actual material for study and investigational purposes should make it easy to keep the work alive with interest. No teacher should be guilty of trying to teach the work on cows as a textbook subject.

KEEPING DAIRY HERD RECORDS

E. S. Savage
Professor of Animal Husbandry

In order to breed a herd of cows intelligently and to select out those that are not paying their way, it is necessary to keep records of production. A simple piece of home work under school direction may be developed so that the children on dairy farms may have a valuable problem, and at the same time obtain results that will be very useful to the parents. Such a plan will help the father, the child, and the teacher to establish points of contact.

To know accurately and completely the cost of producing milk, a set of books must be kept for the farm, but it is not desirable to attempt this at first. The work directed from the school had better be limited in the beginning to simple records of the production of milk and butterfat by each cow in the herd.

The keeping of dairy herd records requires two pieces of equipment — a Babcock test outfit and a spring balance scale that will weigh in pounds and tenths up to thirty pounds. Both of these may be found in many communities, and the owners are usually glad to lend them to the school for limited periods. A number of rural schools now own Babcock testers as a part of their equipment, and probably it would be possible for many

Name of pupil _ _ _ _ _ _ _ _ _

Milk record for week beginning _ _ _ _ _ _ _ 19 _ _

Name of cow					
Date		Pounds	Pounds	Pounds	Pounds
	A.M.				
	P.M.				
	A.M.				
	P.M.				
	A.M.				
	P.M.				
	A.M.				
	P.M.				
	A.M.				
	P.M.				
	A.M.				
	P.M.				
	A.M.				
	P.M.				
Total for week					
Per cent fat					
Pounds fat					

Remarks:—

A SIMPLE FORM OF MILK RECORD

others to obtain one if the teacher and pupils showed themselves in earnest over the cow study work. A six-bottle enclosed tester, such as is best for school purposes, can be bought from any reliable dairy supply house at a considerable discount if it is made clear that it is to be used for educational purposes. The list price has been about nine dollars in years past, but it may be higher now. The spring balance will cost from three to four dollars if bought new. A combination arrangement might be worked out whereby each pupil doing the work would have a balance at home, but all could use the tester at school.

Naturally the complete milk record problem would involve keeping a daily record of the milk yielded by each cow at each milking for one year for the whole herd. This is likely to be more of a task than a boy or a girl can successfully undertake, although if the herd is not a large one, and the pupil is interested, it might be done. Of course the problem can be lightened by taking only three or four cows at one time. There would be real value in doing the work well even with one or two. It is best not to reduce the period of the work to less than the whole time during which the cow gives milk (approximately ten months) because the complete record is the only valuable one. Thus, this piece of work is a long-time experience, and the teacher will have to stimulate and encourage the pupil and keep up his interest and enthusiasm so that he will carry it through to the end.

The records may be kept on a sheet that the pupil rules for himself. This sheet should contain all the records for one week. A simple form is given on page 81. As many vertical columns should be provided as there are cows being tested. The total records on these weekly sheets may be posted in a bound book ruled in much the same way with a page for each cow to show the yearly record. Three columns for each cow are needed for this yearly record, one showing the pounds of milk, one showing the percentage of butterfat, and the other the pounds of fat. There would be a maximum of fifty-two entries for the year in each column.

At the evening milking on one day each week a small sample of the milk from each cow should be taken and a sample of equal size of the milking the next morning. The milk should be thoroughly mixed before taking the sample. These two samples should be kept cool, mixed together, and the combined sample tested for butterfat at school the day the morning sample is taken.

It will be best to plan the work so that the evening sample and the last record for the week will coincide. Then the production of the previous week can be added up on the day that the Babcock test is made. The test is considered as applying to all the milk given by the cow for the preceding week. Multiplying the pounds of milk by the percentage of

MILK WEIGHING AND SAMPLING OUTFIT

MILK TESTING OUTFIT

butterfat indicated by the test, will give the yield of butterfat for the week. For example, 100 pounds of milk that tested 4 per cent yielded 4 pounds of butterfat.

It is safe to say that, at the present prices of feed, any cow four years old or over that is not producing in a year 7000 pounds of milk testing $3\frac{1}{2}$ per cent fat, or its equivalent, is not paying much profit. The amount of butterfat is the important thing, and of course the richer the milk is in fat, the less quantity it will be necessary to produce to make a given amount of fat.

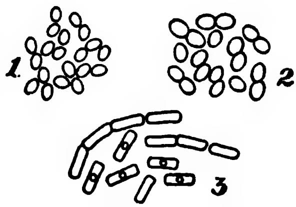
HANDLING MILK

W. A. Stocking, Jr.
Professor of Dairy Industry

Every one knows that if milk is allowed to stand in a warm room for any length of time, it becomes sour and finally curdles. Not every one, however, knows why these changes take place.

Milk becomes sour and curdles because it contains bacteria that change the milk sugar into lactic acid. At first milk usually contains only a small number of these acid-producing bacteria, but they multiply very rapidly, and when they have produced enough acid, the milk begins to taste sour. As the bacteria grow and the amount of acid increases, the milk becomes more and more sour until it finally curdles.

The organisms that cause milk to become sour belong to a group of minute plants. They are the smallest plants known — so small, in fact, that it takes many thousands of them placed side by side to make a row an inch long. They cannot be seen with the unaided eye, and individual bacteria plants can be seen only by the aid of a high-power microscope. It is because of their minuteness that they are not seen in milk, but their presence is made known by the changes that they produce in the appearance of the milk and in its taste.

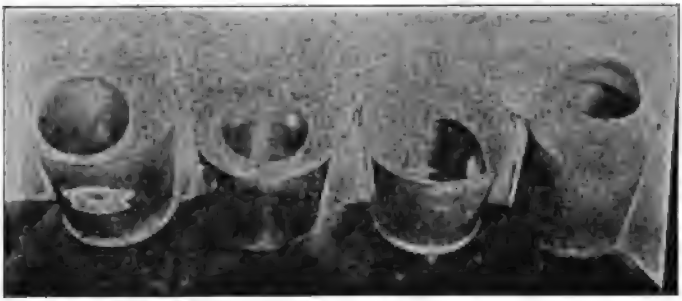


SOME OF THE BACTERIA COMMON IN MILK. SEE TEXT

Three forms of bacteria are given in the illustration: 1 causes milk to sour and is the organism used for ripening cream; 2 produces gas and is the cause of gassy cheese; 3 causes milk to putrefy.

Besides being the smallest in size, bacteria are also the simplest in form of any of the plants. A mature, full-grown bacterium plant consists simply of a little cell, or sac, filled with protoplasm, or living substance. Some of these plants are round like a ball, while others are cylindrical in form, as shown in the illustration. But no matter which shape the organisms are, the structure is always very simple.

Bacteria are present in large numbers in the air, and especially do they abound in dust and dirt of all kinds. Thus it is important in handling milk to keep it as clean as possible. Practices that aid in this are: (1) cleanly habits on the part of the person who milks; (2) wearing clean milking clothes if possible; (3) washing the udder and the flank of the cow before milking; (4) using a milk pail with a small opening; (5) caring for the milk promptly after it is drawn; (6) thoroughly washing and sterilizing all milk containers after each use.



TYPES OF SANITARY MILK PAILS

Boys and girls can experiment for themselves with some of these things. For example, in order to show the effect of washing the cow before milking, draw the milk from one of two cows into a pail in the ordinary way without any previous brushing or cleaning, mix the milk thoroughly, and take a sample of it in a bottle or a tumbler. Before milking the second cow, thoroughly dampen and wipe the flank and the udder with a clean cloth wrung out of a pail of clean water. Be sure that all the parts are moistened, especially those with which the hands will be in contact while milking. Rinse the hands in clean water, and dry them on a towel. Draw the milk from this cow into a clean milk pail, and take a sample in another bottle. Cover both bottles by tying a piece of clean paper over each one, and set them away together. Watch the two samples carefully, and determine which one curdles first and how much difference there is in the time of curdling. This demonstration should be repeated several times until the results are clearly proved.

A similar test can be made of the use of different kinds of milk pails. Draw the milk from one cow into an ordinary large-topped milk pail, and take a sample in a jar or a bottle. Draw the milk from a second cow into a small-topped pail, and take a sample. Cover the two samples, set them away, and note when curdling takes place. In general the smaller the opening in the milk pail, the better it is, so long as it can be conveniently used. Any of the styles shown in the illustration will give satisfactory

results and are easy to use. Or, almost any tinner can make a cover with an opening about six inches in diameter at one side, to fit an ordinary milk pail.

It is of greatest importance in the handling of milk that all utensils should be thoroughly sterilized either with boiling water or with steam each time they are used.

Another factor in the handling of milk has to do with the conditions that influence the growth of bacteria. Like all higher plants, bacteria grow best at warm temperatures, and much more slowly if kept cold. This is the reason that milk should be cooled immediately after it is drawn, and should always be kept in a cool cellar or in an ice box.

The growth of the acid-forming bacteria in milk can be observed in the following way: Obtain a quantity of milk, mix it thoroughly, and pour equal quantities into each of four pint bottles or glass fruit jars, which have been thoroughly washed and scalded. Cover the bottles with paper to prevent the entrance of dust. Place one bottle in ice water, one in water at 55° or 60°, one at 70° to 75°, and the other at 90° to 100° F. It will be well to shake the bottles frequently when first put into the water, until the milk becomes the same temperature as the water. Keep the water at the given temperatures, and notice when the milk in each jar first tastes sour, and also when it curdles. It will be well to start this experiment as early in the morning as convenient, and maintain the different temperatures during the day, making an occasional observation to determine when the milk begins to sour. Start with milk that is a few hours old, so that the milk kept at the warmest temperatures will curdle before night. Probably the bottle kept in ice water, and possibly the one at 50°, will not curdle before the next day.

GRADES OF MILK

H. E. Ross

Professor of Dairy Industry

The value of milk as a food is influenced by two things: by its chemical composition and by its sanitary quality. Milk as given by different breeds of cattle and by individuals of the same breed varies in its chemical composition. Some breeds normally give large quantities of milk containing a comparatively low proportion of total solids, while others give a less quantity of milk containing a high proportion of solids. It cannot be denied that from the standpoint of food value milk containing a higher proportion of total solids is more valuable, because in a given quantity there is more food value than in the same amount of milk with a low proportion of total solids. But the sanitary condition of milk is of much

greater importance than the proportion of total solids. No matter what the chemical composition of milk is, if it has become contaminated with anything injurious to health, the milk is unfit for food.

In nearly all cases milk that is unfit for human food is rendered so by the action of microorganisms, chiefly bacteria. These microscopic plants are present nearly everywhere. A diseased animal may be responsible for the bacteria in milk, but usually they gain entrance while milk is being drawn and during its subsequent handling, and frequently after it has been delivered to the consumer. Of course not all the germs that

AN INEXPENSIVE BARN BUT ONE IN WHICH CLEAN MILK IS PRODUCED BY MEANS OF CAREFUL ATTENTION TO METHODS

get into milk are harmful, but many cases are on record where infectious contagious diseases have been spread by milk. A large number of germs in milk are indicative either of careless methods of production or of careless methods of handling. These careless methods increase the possibility of the infection of milk with disease-producing bacteria. For this reason the bacteria content is one of the main features in grading milk.

The next point of importance in grading milk is the sanitary score of the barns and other conditions surrounding milk production and handling. While it cannot be denied that the methods used in milk production are more important than the equipment, yet most milk producers do better work with good equipment than with poor.

The requirements for clean milk production vary somewhat with the locality in which milk is produced, but these two factors, the bacteria

content of the milk and the score under which the milk is produced, are the basis of nearly all sanitary requirements for clean milk production. The main purpose then in grading milk is to indicate to the consumer the care and the treatment that milk has had before it is offered for sale. It is left to the consumer to buy the kind of milk he wishes.

The first distinction of great importance in grading milk is that between *raw milk* and *pasteurized milk.* Raw milk has not been heated, while pasteurized milk has been heated to a temperature sufficiently high and

INTERIOR OF BARN SHOWN ON OPPOSITE PAGE

for a time sufficiently long to kill most of the organisms in it. Heating and maintaining milk at temperatures high enough to sterilize it changes its chemical composition and imparts a cooked taste, which is objectionable to the consumer.

Probably the highest grade of raw milk is *certified milk*, which is produced under the supervision of a medical milk commission. This commission is appointed by a county medical society and may consist of any one interested in the enterprise, but always some of its members are persons trained in sanitation, such as doctors, veterinarians, bacteriologists, and chemists. Every possible precaution to make certified milk safe is taken in its production. Among these precautions may be

mentioned frequent examination of cows for tuberculosis and other diseases by a competent veterinarian, examination of the physical condition of the employees, washing the cows before each milking, sterilizing all utensils with which the milk comes in contact, and cooling the milk as soon as it is drawn to a temperature sufficiently low to prevent the growth of the few germs that may be in the milk. Most commissions also state the length of time that the milk may be offered for sale. The New York State Board of Health makes it very emphatic that no certified milk shall be sold or offered for sale as such, unless it bears the certification of a medical milk commission.

Many dairymen produce milk of high quality but do not wish to certify it under a medical milk commission. Milk of this grade goes under various names, such as special milk, baby milk, selected milk, and the like. This milk may be equal in quality to certified milk, but the public should be warned against putting too much dependence in names of this sort as sometimes they mean nothing and are simply used to catch the eye of the public. There is not this danger with certified milk, because the word *certified* in reference to milk production is copyrighted in the United States Patent Office, and no one has a right to use it unless he is producing milk under the supervision of a medical milk commission.

In the class with certified and other milk produced under special conditions should be mentioned *modified milk*. This is produced under sanitary conditions and changed in composition to suit the needs of infants and invalids. It is always put up according to the prescription of a physician. This makes it possible for a physician to have the composition of milk changed in any way, such as increasing or decreasing the fat, sugar, or albumen content. Modified milk laboratories have been established in nearly all the large cities both in the United States and abroad, and have been very useful in enabling physicians to obtain the kind of milk they needed in their practice.

In January, 1915, the New York State Board of Health passed regulations governing the sale of milk in all municipalities in the State with the exception of New York City (Chapter III of Sanitary Code, New York State Board of Health, Albany, New York). These rules lay down certain general regulations in regard to permits and their renewal, storing of milk, sanitary conditions of surroundings under which milk is held, cleanliness of utensils, and the like. The Board of Health also states that pasteurization will be interpreted by it as subjecting milk or cream to an average temperature of 145° F. for 30 minutes, that the milk or cream pasteurized must be cooled at once, and that no milk nor cream shall be pasteurized more than once.

The milk and the cream sold in municipalities are divided into six classes as follows: Grade A Raw and Grade A Pasteurized, Grade B Raw and Grade B Pasteurized, Grade C Raw and Grade C Pasteurized. There are several requirements for each class, but the points of main interest are the requirements for the health of animals, the barn score, the bacteria count, and the method of marking.

CLEANLINESS PAYS

Grade A Raw: (1) health of animals, cows tuberculin tested at least once per year and all those that show a reaction removed; (2) barn score, at least 25 for equipment and 50 for method; (3) bacteria count, milk not more than 60,000 and cream not more than 300,000 bacteria per cubic centimeter at any time previous to delivery; (4) caps or tags printed in large black type "Grade A Raw" with name and address of dealer.

Grade A Pasteurized: (1) health of animals, annual physical examination; (2) barn score, 25 for equipment and 43 for method; (3) bacteria count, milk not more than 200,000 bacteria per cubic centimeter before pasteurization, milk not more than 30,000 and cream not more than 150,000 bacteria per cubic centimeter after pasteurization and before delivery; (4) caps or tags printed in large black type "Grade A Pasteurized."

Grade B Raw: (1) health of animals, annual physical examination; (2) barn score, 23 for equipment and 37 for method; (3) bacteria count, milk not more than 200,000 and cream not more than 750,000 bacteria per cubic centimeter at any time previous to delivery; (4) caps or tags printed in large green type "Grade B Raw" with name of dealer.

Grade B Pasteurized: (1) health of animals, annual physical examination; (2) barn score, 20 for equipment and 35 for method; (3) bacteria count, milk not more than 300,000 bacteria per cubic centimeter before pasteurization, milk not more than 100,000 and cream not more than 500,000 bacteria per cubic centimeter after pasteurization and previous to delivery; (4) caps or tags printed in large green type "Grade B Pasteurized" with name of dealer.

Grade C Raw: (1) barn score, total score of 40; (2) caps or tags printed in large red type "Grade C Raw."

Grade C Pasteurized: (1) barn score, total score of 40; (2) caps or tags printed in large red type "Grade C Pasteurized."

The score card used is one prescribed by the State Commissioner of Health, and all caps and tags used are to have a white background in order to make the printing on them easily distinguishable.

MILK AND ITS CONSTITUENTS

H. C. Troy

Professor of Dairy Industry

Milk is the only substance produced by nature for the sole purpose of serving as a food for animals. It contains all the substances required by infants to supply growth and energy during the first few months of their existence. A necessary part of the diet of all growing children is also formed by milk and its products because they contain to a greater extent than do most other foods certain substances that stimulate growth. The food of adults also contains a large portion of milk products. For these reasons it is often stated that milk is the most important human food. Pure milk always contains the same substances, but the proportion of each present may vary to some extent. For convenience in describing the milk constituents they may be divided into different groups. The first division separates them into water and total solids. The latter may be divided into fat and solids not fat, and the solids not fat may be separated into sugar, casein, albumen, and ash.

Average Composition of Milk Given in Percentage of Water and Solids

- Milk
  - Total solids . . 13.0
    - Fat 4.0
    - Solids not fat . . 9.0
      - Sugar 5.0
      - Casein 2.6
      - Albumen . . .7
      - Ash 7
  - Water 87.0

It is quite possible to obtain all these constituents of milk in connection with the school work. The children will learn many facts about milk, the performing of the operations will be interesting and will teach many valuable lessons in care and accuracy, and a desire for experiment and study will be aroused. The materials needed are a quart of milk,

a little vinegar or lemon juice, a thermometer, a bottle, a saucer, a basin, and a piece of cheesecloth for a strainer. If desired, the various constituents may be placed in different receptacles, as in the illustrations, and the relative amounts compared.

MILK WATER

Water is the substance present in milk in the largest proportion. It is derived from the blood by passing through the pores in the walls of the blood vessels during the secretion of the milk. Milk of average composition contains 1 pound of solids in 7 pounds of water. That ratio gives nearly 13 pounds of solids and 87 pounds of water in 100 pounds of milk. This appears to be a large proportion of water, but when it is compared with the percentages of water present in the foods given in the following list it does not seem so surprising.

PERCENTAGE OF WATER IN VARIOUS FOODS OTHER THAN MILK

VEGETABLES	Percentage of water	MEAT	Percentage of water
Potatoes	75.00	Chicken	76.00
String beans	87.00	Turkey	75.00
Turnips	90.46	Pork tenderloin	68.40
Radishes	91.00	Beefsteak	64.00
Beets	88.47	FISH	
Cabbage	90.52	Trout	77.70
FRUIT		Perch	80.90
Peaches	88.00	Cod	82.60
Apples	85.00	Halibut	75.40

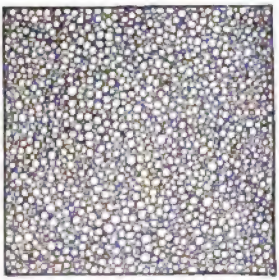
Separating the solids.— Place a tablespoonful of milk in a small flat dish or saucer and set it in a place hot enough to make the milk almost boil. The water will evaporate. The substance remaining is called the total solids because it comprises all of the substances in milk that are not liquids and they appear in the form of a dry solid mass in the dish. These solids are composed of twenty or more substances, but only the groups that may be readily identified are considered here.

MILK-FAT

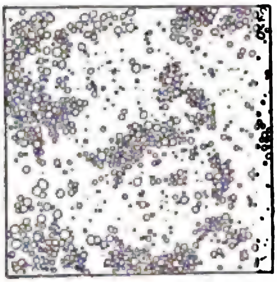
Milk-fat is distinguished from all other fats by its natural yellow color. The color is derived largely from the animal's food, and is more pronounced in the early summer months when the food is green and succulent.

The milk-fat probably comes partly from the body fat of the animal, partly from the proteids of the secreting cells in the udder through fatty degeneration, and partly from chemical bodies brought to the udder in the blood. The food and the body fat undergo a change in passing through the udder so that they have new and desirable properties. The fat

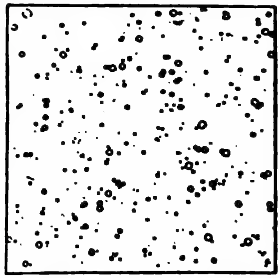
occurs in milk in the form of little round balls, or globules. They appear like minute air bubbles floating in the milk serum when they are seen through a high-power microscope. The globules of fat are lighter than the serum with which they form a temporary emulsion; hence when milk is left in a cool place without stirring for twelve to fifteen hours, most of these globules gather near the surface under the influence of gravity. The spaces between the globules remain filled with the milk serum. This layer of fat globules and serum near the surface composes the cream. It is the same as the cream obtained by using a separator, only in the latter case centrifugal force brings about the separation. The proportion of fat and serum in cream varies widely, but in New York State the mixture cannot legally be sold as cream unless it contains at least 18 per cent of fat. The fat furnishes about one-half of the food value derived from average milk. It possesses peculiarly desirable flavors, which combined



Cream



Milk



Skimmed milk

MILK AS IT APPEARS THROUGH A HIGH-POWER MICROSCOPE

with its high nutritive value and attractive physical properties, make it a very popular food. For these reasons it commands a higher price than other fats and other milk constituents. The 4 pounds of fat in 100 pounds of fresh milk are worth as much, if not more, on the market than the 9 pounds of other solids.

Separating the fat.— Allow a quart of fresh milk to set quietly in a basin in a cool place for twelve hours or longer. Skim off the cream that rises, put it in a bottle or a fruit can, and churn it by shaking until the fat separates. The lumps of fat on the surface may then be removed and worked in a little water to wash out the buttermilk. A little salt may then be worked into the butter, and it is ready to be eaten.

MILK CASEIN

Casein is one of the most important members of a class of nitrogenous substances called proteins. It occurs in the milk in the form of minute gelatinous particles that remain evenly distributed throughout the serum. Substances that behave in this manner without going into true solution

are known as colloides. Casein has a high food value, and its presence in milk makes it possible to manufacture cheese, of which it forms a large part. Its use in the manufacture of a great variety of articles is constantly growing.

Separating the casein.— Allow a pint of the skimmed milk from which the cream was removed, to set in a warm place until it sours and coagulates, or the casein may be coagulated at once by stirring into the skimmed milk a little acid substance, such as lemon juice or vinegar. It should be allowed to remain quiet for a short time, when the thickened mass may be cut or broken into lumps and gently warmed. The watery portion,

A B C D E F

THE COMPOSITION OF AVERAGE MILK

A, Ash .7%; B, Albumen .7%; C, Casein 2.6%; D, Fat 4%; E, Sugar 5%; F, Water 87% by weight. The seemingly disproportionately large amounts of casein and albumen are due to the fact that these substances are flaky and do not pack so tightly as the fat and the ash.

called whey, will then separate gradually from the casein. Pour off the whey when the casein has contracted to less than half its original volume. Then place the casein on a cloth strainer or draining board until most of the remaining whey has drained off.

MILK ALBUMEN

Albumen is the other important protein of milk. The amount present is about one-fourth that of the casein. It differs chemically from casein by not containing any phosphorus. It differs in physical properties from casein by not being coagulated by acids, but is thrown down by heat. It has a high food value and is sometimes made into a special variety of cheese by heating the whey.

Separating the albumen.— Strain the whey from the casein to remove all undissolved particles. Then heat the whey to 200° F. in a porcelain-lined dish, using care not to scorch it. Remove the dish from the source of heat, and the albumen will settle to the bottom as a whitish flocculent mass. The albumen may be separated from the liquid by straining.

MILK SUGAR

Sugar makes up more than one-half of the solids not fat in milk. It is usually manufactured from the whey obtained in cheese making. While cane sugar is sweeter than milk sugar, they are of equal food value. Through the action of acid-forming bacteria a part of the milk sugar is converted into lactic acid in the ripening of cream. It is this acid that gives buttermilk and sour milk the sour taste. Milk sugar is used in the preparation of medicine and in solutions for infant feeding in cases of delicate digestion.

Separating the sugar.— Evaporate the liquid removed from the albumen to dryness in a white porcelain dish. Care must be taken not to overheat it when nearly dry or it will darken. The grayish granular substance remaining in the dish is largely milk sugar. Some mineral matter remains, and it is very difficult to separate it from the sugar even under the most favorable conditions.

MILK ASH

When milk is dried and the milk solids are slowly burned off and then heated to redness for a time, there will finally remain a gray powder, which is the ash, or mineral matter, of milk. The amount of mineral matter in milk is small, but it is a very important part of the food of infants because it supplies the bone-forming material during the period of rapid growth.

Separating the ash.— Evaporate some of the skimmed milk to dryness on a dish that may be heated to redness or on a smooth piece of metal, such as a stove lid. Then heat the container nearly to redness and continue heating until the blackened milk substance changes to a gray powder. This gray powder is the ash. It is not, however, in the same form as when it was in solution in the milk, as its composition has been changed to some extent while burning off the other solids.

Each person should be expert in some
one thing; then people will ask for it.

ALICE GERTRUDE McCLOSKEY

BUTTER

E. S. Guthrie
Professor of Dairy Industry

Butter may be grouped into two general classes: creamery butter, which is manufactured in butter factories or creameries, and dairy butter, which is made on farms. The composition of these two classes of butter is practically the same. The quality of creamery butter is usually superior to that of dairy butter, for the creamery man is more expert in making butter than is the dairyman and the equipment of a creamery is better than that on the dairy farm.

CREAMERY BUTTER

There are two general groups of creamery butter: first the whole-milk butter, and second, the gathered-cream butter. Whole-milk butter is manufactured in creameries to which the farmers draw their milk and in which it is separated. In such case the farmers may or may not take the skimmed milk home. Gathered-cream butter is made from cream that has been separated on the farm and that has been gathered largely by route drivers. Cream is usually collected every two or three days; whereas milk must be taken to the creamery every day during warm weather and on alternate days during winter, for sour milk cannot be separated. It is possible to make butter from cream that is sour when it is received; however the quality of such butter is inferior to that made from cream that is clean and sweet when it is received or that is separated from the milk in the creamery.

The first essential in making good butter is proper care of the milk-fat from the time that it leaves the cow until it is in the finished product. In case the milk is delivered to the creamery, it should be properly cooled to 60° F. or below to hold in check the growth of bacteria. When the cream is sold, the separation should be done immediately after milking while the milk is still warm, and the cream should be cooled to below 50° F., for it is usually held longer than milk.

When the whole milk or the cream arrives at the creamery, it is examined by the creamery operator for flavors and odors. If they are good, it is received; otherwise it is returned to the farmer. When received, the milk or the cream is weighed and sampled. In the case of milk it is then allowed to run or is poured into the receiving vat.

The samples of milk and sometimes the samples of cream are composite of each day's milk and are held for two weeks, at the end of which time the milk is tested for milk-fat, and at the end of a month a second composite sample is tested. Then the total amount of fat for the month

is computed as follows: The sum of the milk delivered by each patron for the first one-half of the month is multiplied by the test of the composite sample of milk during that period. This is repeated at the first of the following month for the remainder of the month. The sum of the two amounts of fat is taken as the basis of payment. Thus the farmer is paid for the fat that he delivers to the creamery, and not for the bulk weight of the milk, for there is great variation in the proportion of fat in milk. The cream is usually not sampled by the composite method but is tested every day or as often as the cream is delivered. The composite samples are usually held in glass-stoppered bottles to prevent evaporation, and they are preserved with corrosive sublimate or some other agent so that they will not sour. It is difficult to make an accurate test of milk or cream when it is sour.

During the process of separation the milk may be allowed to flow by gravity, or it may be pumped from the receiving vat through a milk heater in which the temperature is brought to approximately 90° F. Cold milk cannot be efficiently separated. From the heater the milk is run into the separator, which by centrifugal force separates the cream from the serum. The cream, which should ordinarily contain from thirty to forty per cent of fat, is then placed in the cream ripener, where it may also be pasteurized or it may be put through a pasteurizer before it gets to the ripening vat.

The pasteurization consists in raising the temperature sufficiently high to kill nearly all the bacteria and then in lowering it again. When cream is run through a flash pasteurizer, the temperature should reach 165° to 170° F. When cream is held in the vat for thirty minutes, 145° F. is sufficiently high. The cream is then cooled to the ripening temperature, which is usually 60° to 70° F. Pasteurization kills disease-producing bacteria and helps to maintain a better flavor than when the cream is unpasteurized.

The next step is to introduce desirable bacteria for the souring, or ripening, of the cream. The milk that contains these bacteria is known as starter. The cream is ripened at approximately 65° F. for three to six hours, or until it is sufficiently sour to suit the market. Then it is cooled to from 50° to 55° F. and held at this temperature overnight.

The next morning the cream is placed in the churn at such a temperature that the churning process will be done in from thirty to forty-five minutes. In case color is added, a sufficient amount to satisfy the trade is put in the cream. During the summer when the cows are on grass it is not often necessary to add color. The churning process is complete when the granules of butter are about the size of a kernel of corn. The buttermilk is drawn off when the churning is completed. The butter should be washed

twice with about as much water as there was buttermilk, and at such a temperature that the butter will have a pleasing waxy appearance. The purpose of washing the butter is to remove the buttermilk, and thus the milk sugar and the proteids of the buttermilk are not left in the butter to supply the bacteria with food. Bacteria do not live on the milk-fat. Butter that has been properly washed keeps better than unwashed or poorly washed butter.

After the butter is washed, salt is added in sufficient quantity to satisfy the demand of the consumers. Usually about one ounce of salt to each pound of milk-fat is satisfactory. The butter and salt should be thoroughly worked in order to get a uniform distribution of salt; otherwise mottles or streaks will appear in the butter after it has stood a few hours. It is largely in the working process that the moisture is controlled. The moisture in butter must not reach sixteen per cent, for then it is considered by the Federal Government to be adulterated and the maker is subject to a fine.

The final step in handling butter in a creamery is to pack it in a suitable package or to put it in desirable prints. Whatever may be the call of the trade in relation to the style of package, the demand is always for neatness and for a finish that will please the purchaser.

DAIRY BUTTER

Dairy butter is usually made in small quantities, and is not the first consideration on the farm. Therefore it is not made so carefully as is creamery butter, nor is it handled so efficiently as other things that bring in a greater income to the farmer.

The first essential, as already stated, is the proper care of the milk-fat. The second step after milking is the separation of the milk into cream and skimmed milk. At the present time, when the prices of dairy products are high, it pays to purchase a modern centrifugal separator when there are at least three or four cows in the herd, rather than to use one of the old gravity methods of skimming the cream. The advantages of centrifugal separation over gravity methods of skimming may be enumerated as follows: 1. Ordinarily less utensils are used. 2. More efficient separation is done. 3. It is easier to cool the cream than it is to cool the milk, for the quantity is much less. It should be noted that in the gravity method the milk must stand about thirty-six hours before the cream may be skimmed off; whereas separation may be done immediately after milking when the centrifugal separator is used. 4. The skimmed milk is fresh and warm, which is a decided advantage in feeding some kinds of stock.

There are two methods of ripening cream on the farm. The one that is generally used is to cool the cream and to hold it for two or three days,

or until a sufficient quantity has accumulated to churn. Then the temperature is raised to such a point that the cream becomes sour. This temperature is usually from 70° to 80° F. Buttermilk or sour milk may be added, in which case temperatures of 60° to 70° F. are used. The other method of ripening cream on the farm consists in souring it as it accumulates. It is necessary to use lower ripening temperatures than in the first method, for the cream is likely to overripen, thus producing a strong flavor in the butter. The latter method is used to prevent the formation of a bitter flavor, which is caused by bacteria that grow at low temperatures in milk or cream when they are sweet. These bacteria will not grow in an acid solution, such as sour milk or cream.

The churning and the working processes are the same as in the making of creamery butter, with the exception that the churning temperatures must be about 4° or 5° F. higher. This is because the agitation in the small churns is not so great as in the large creamery churns. The same care in placing the butter in proper packages and in putting it on the market in neat and attractive condition should be observed as when handling creamery butter.

BEEF

K. J. Seulke
Assistant Professor of Animal Husbandry

Beef is the name applied to the meat obtained by slaughtering mature cattle regardless of whether they are of beef or dairy breeding, young or old, male or female. This meat may come from many parts of the carcass, and the various cuts or parts are called by different names so that they may be distinguished from one another, for each has a particular use or uses that may or may not apply to another cut.

Beef is generally used in a fresh condition on the farm, but it may be kept in fresh or frozen condition for varying lengths of time, and may be kept almost indefinitely by being cured in various forms.

The choicest beef is obtained from animals of beef breeding, for these animals have been produced for many generations with this end in view. Not only do their carcasses produce a larger amount of edible meat in relation to live weight, but the proportion of meat to bone is greater and the fat is more evenly distributed throughout the meat with no large amount in parts of the carcass where it must be trimmed out and have little value as food. Although animals of beef breeding make the choicest beef, still very good beef may be obtained by slaughtering animals of dairy breeding that are of the proper age and degree of fatness, and in good health.

The most desirable age for an animal of any breeding intended for beef purposes is from two to four years. Young unsexed males that have been fattened and that are in good health and free from disease are most desirable, although females of the same age that have not produced young will give practically as good results.

SIDE OF BEEF

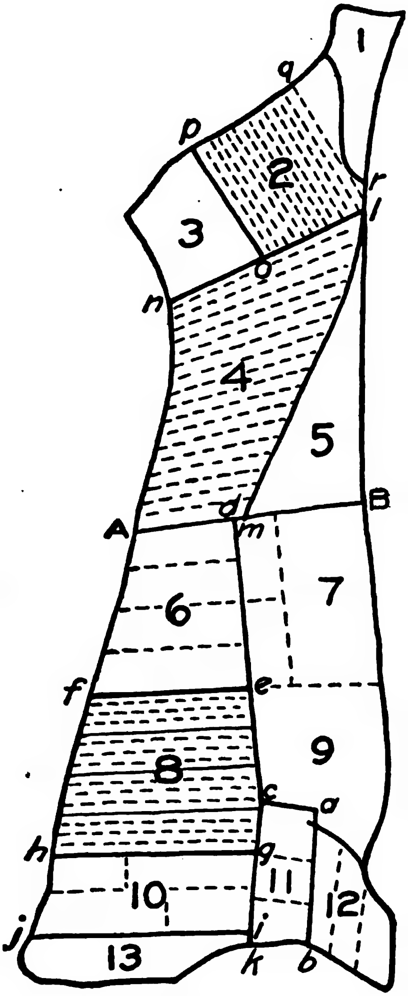
CUTTING BEEF

When the animal is slaughtered and dressed, the head, the hide, the feet, and all internal organs except the kidneys and kidney fats, are removed, and the carcass is split down the center of the backbone thus dividing it into halves. Since the two sides, or halves, are cut up in exactly the same manner, it will only be necessary to describe the cutting of one side.

Wholesale cuts.— Before the various retail cuts can be made, the carcass must be divided into the larger, or wholesale, divisions. Since the side of beef is too large to be easily handled, it is first divided into the fore and the hind quarter in the following way. The person doing the cutting stands so as to face the inside of the side of beef, inserts the knife above the last rib (for the side hangs by the hind leg), and cuts forward to a point three inches from the edge of the flank. He then goes around to the outside of the carcass, inserts the knife in the cut just made, and, keeping the knife flat against the rib, cuts down to a point four inches from the backbone and then straight out to the back. The backbone is then sawed through, and after a table is placed under the quarter or a man has placed himself in a position to carry the fore quarter, the portion of flank that connects the two is cut and the fore quarter is carried to a block or drops to the table where it is laid with the outside upward. The cut just made is shown in the diagram by a heavy line (AB) running horizontally across the carcass.

After the fore quarter is laid on the block, the shank (12) is removed

by cutting directly through the joint (ab). Next, the plate (7 and 9) is removed. This is done by continuing the cut made in removing the shank through the part of the breast that lies beneath it and continuing this cut back to between the second and third ribs from the front. A cut is then made from a point (c) between the second and third ribs and on a line one inch below the shoulder joint to the cut made in the breast (a). Then a long cut is made from a point (d) two inches below the heavily muscled portion of the rib to the point c. This removes the plate consisting of brisket (9) and navel (7). The cross rib (11) is removed by cutting from c to k, or an inch below the shoulder joint. The prime rib (6) is removed by cutting between the fifth and sixth ribs (counting from the front) from e to f. The chuck rib (8) is removed by cutting (gh) between the first rib and the shoulder joint (g) parallel to the cut (ef) made in removing the prime rib. The neck (13) is then removed from the shoulder (10) by cutting off (ij) the thin portion parallel to the cut (gh) made in removing the chuck rib.



BEEF CUTS

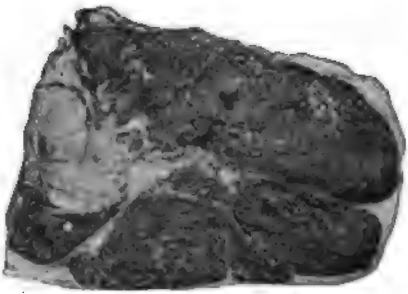
For explanation of numbers and letter see text

After the fore quarter is cut, the hind quarter is laid on the block with the inside upward and the kidney fat is removed. The flank (5) is next removed by cutting from the cod fat or udder (l) to a point one to two inches below the heavily muscled portion of the porterhouse at m, removing all of the thin portion of the flank without cutting into the thickly muscled portion of loin or round. The loin (4) is removed by cutting through the center of the rise in the backbone (n) and in front of the pelvic bone at o to l. This cut should remove a small disk of cartilage from the hip joint. The rump (3) is removed by cutting in front of and parallel to the pelvic bone (op). The

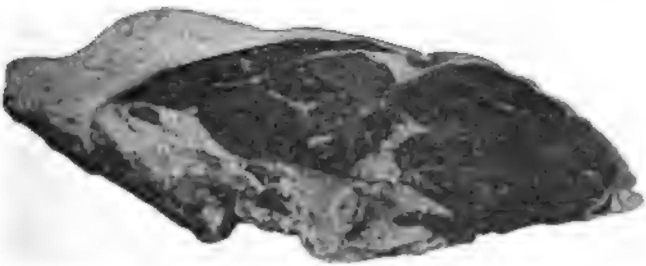
round (2) and the hind shank (1) that remain are not separated in the wholesale cutting because the round is hung up by the shank.

Retail cuts and their uses. — The round is cut up on the retail market by removing round steaks, as shown in the diagram, down to point r, where the knee joint is found. When this point is reached, the triangular bundle of muscle on the back of the leg is removed and used for a roast, while the hind shank (1) and the front shank (12) are used for soup bones. The brisket (9), the navel (7), and the flank (5) are used principally for stews, although a steak may be removed from the flank. The rump (3), the shoulder (10), and the cross rib (11) are used for pot roasts to a large extent. The prime rib (6) makes the choicest roast in the carcass and is practically always used for that purpose. The chuck rib (8) may be used for either oven or pot roasts. The neck (13) is used in case a juicy lean, not especially tender piece of beef is desired, such as in hamburg, mincemeat, and the like.

ROUND AND HIND SHANK



RUMP

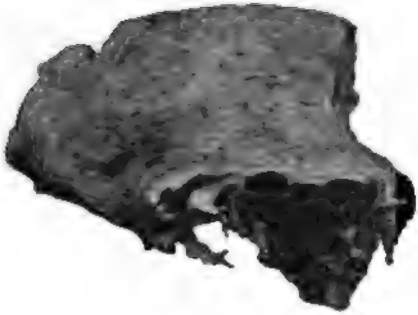


SIRLOIN

All the cuts on this and the two following pages are the same relative size

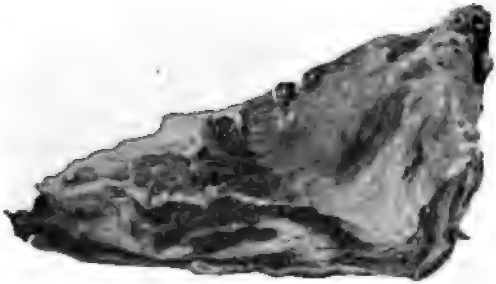
All the cuts mentioned with the exception of the round, the prime rib, and the chuck rib are not cut in any regular form, but are cut in pieces to suit the needs of the consumer. The person doing the cutting keeps in mind the fact that the pieces should be cut in such a manner that they may be carved

across the grain of the meat when brought to the table and thereby be made as tender as possible. The prime rib is always cut by splitting between the ribs, and the pieces are never cut entirely in two by cutting across the ribs. The chuck, however, is first cut into pieces four inches thick by cutting between the ribs, and then each of these is cut into pieces varying in size to suit the consumer by cutting across the ribs.



PORTERHOUSE

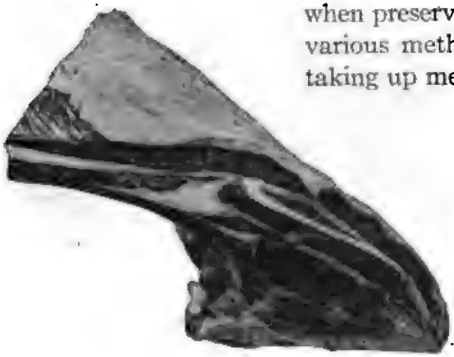
The loin (4) is the most valuable cut in the carcass and is used practically entirely for steaks. The front, or smaller, end of the loin is the porterhouse, while the hind, or larger, end of the loin is the sirloin. The steaks are usually cut about an inch in thickness from whichever end the cut is desired. The porterhouse ends and the sirloin begins at the point where the pelvic bone is first cut into.



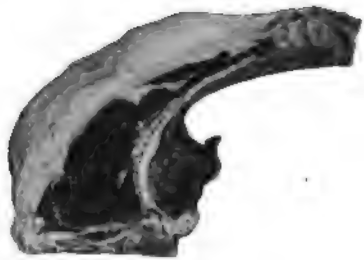
FLANK

KEEPING MEAT

Since certain parts of the animal carcass are more valuable in the fresh state than when preserved, it may be well to consider the various methods of keeping fresh meat before taking up methods of curing



PRIME RIB, SHOULDER END



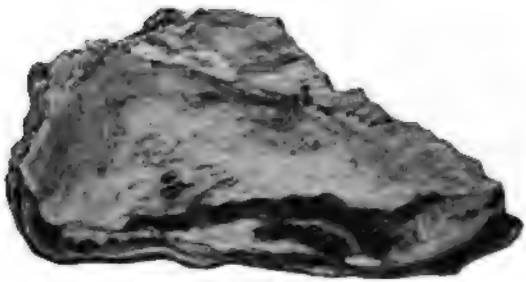
PRIME RIB, LOIN END

All meat to be preserved, either fresh or cured, should be thoroughly cooled after the animal is slaughtered, for unless this is done the meat

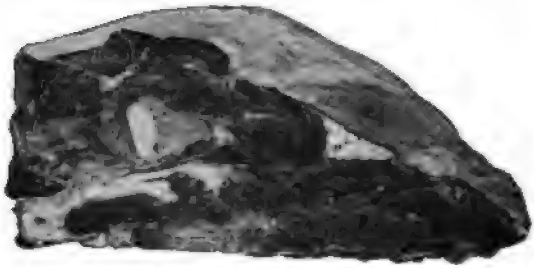
will not cure well nor will it be possible to keep it in a fresh state for any length of time.

In cold weather meat may be kept by hanging it in a dark, cool place, where dogs, cats, and rodents cannot reach it. If a temperature below 40° F. is maintained, meat may be kept for weeks; but with the temperature alternating between low and high, it will not keep well. Meat that is frozen will keep indefinitely so long as it remains frozen. Alternate freezing and thawing will spoil the flavor and cause early decomposition. It is important that the meat be kept in a place where the air is dry. A dark, cool cellar, or an attic that is dry and free from odors, is the proper place for keeping meat on the farm.

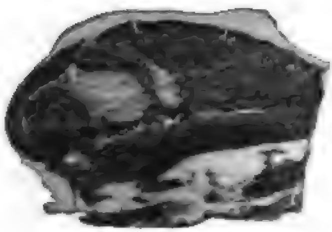
Meat packed in snow may be kept for a con-



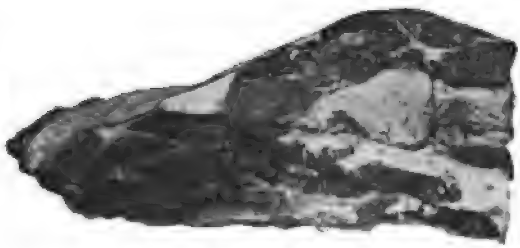
PLATE



CHUCK

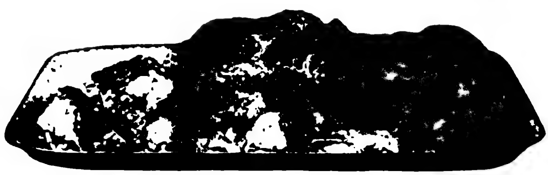


CROSS RIB



SHOULDER

SHANK



SUET

siderable length of time. The meat should first be frozen hard. After it is frozen, an earthen jar or a barrel should be provided, and a thick layer of snow should be tamped tightly in the bottom of this. On the snow a layer of meat is packed, and covered with another layer of snow. Care must be taken to have a thick layer of snow between the meat and the inner surface of the receptacle. Another layer of meat is then put on, and another layer of snow, and so on until all the meat is packed or the jar is almost full, when a heavy covering of snow should be put on top and covered with a block or some other object in order to keep out rats and mice. The meat may be taken out as needed, and the snow should be repacked on top each time.

Another method that is commonly used with pork and sausage is to partly cook the meat by frying it on both sides, to pack it in a jar, and to pour hot lard over it in order to seal the whole and keep out air. The meat may be taken out as needed. Care should be taken each time to melt the lard that is taken off, and to pour it back.

CURING BEEF

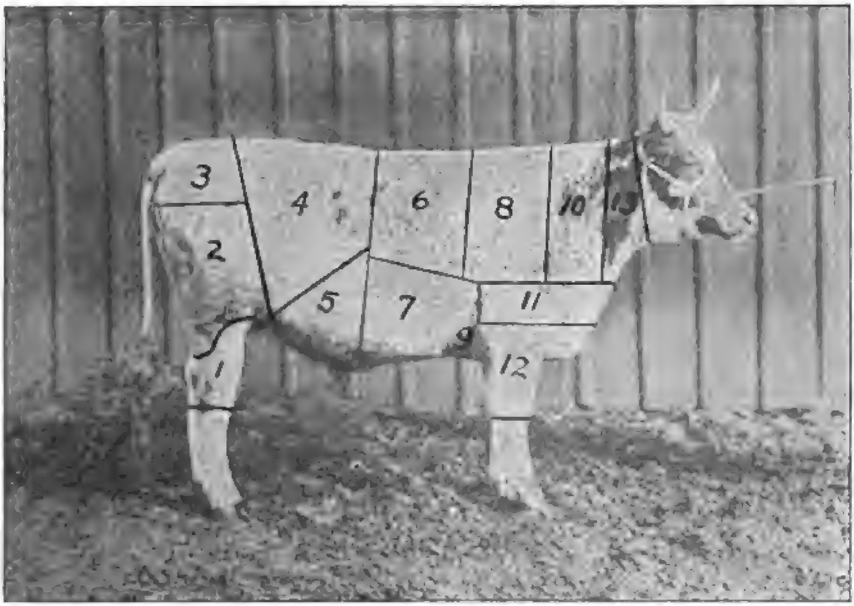
Beef is not so commonly cured as pork; but when corned it takes the place of fresh beef during periods of the year when fresh beef does not keep well, and also offers a method of preserving part of the meat until it is needed, and thus saving a waste or loss of meat, since it is impossible for one family to use an entire beef carcass in the fresh state. Dried beef commands a high price on the market. It also offers a method of preserving meat for future use. Jerked beef is made in the drier regions of the West. The climate in New York State is not dry enough nor warm enough to cure it successfully, and it is not so palatable as dried beef.

Corned beef.— Since corned beef is used for practically the same dishes as fresh beef, only wholesome, untainted meat should be used for this purpose. Naturally, the choicer the meat that is put into the pickle, the better will be the meat that comes out. The cheaper cuts of beef are ordinarily used for corning, because the choicer cuts are more palatable in a fresh condition. Plate, flank, shoulder, chuck, cross ribs, and rump are most commonly used for corning.

Frozen meat should not be put into the brine; neither should the brine be frozen while the meat is in it.

Weigh the meat. Cut it in pieces about six inches square. Place a layer of salt at the bottom of the vessel in which the meat is to be packed, cover this with a layer of meat, and sprinkle a layer of salt over the meat. Add alternate layers of meat and of salt until the meat is packed. Seven to nine pounds of salt will usually be enough for 100 pounds of meat. Allow the meat to stand in the salt overnight. On the following morning

make a brine, using 5 pounds of sugar, 2½ ounces of baking soda, and 3 ounces of saltpeter for every 100 pounds of meat. Dissolve these ingredients in 4 gallons of boiling water. Allow the brine to cool thoroughly before pouring it over the meat. If more or less than 100 pounds of meat is to be cured, use these proportions for the brine. If 4 gallons of brine does not entirely cover 100 pounds of meat, water may be added. The meat should be weighted down with a block or a clean stone, since any part that is not covered with the brine will decompose very quickly.



BEEF ANIMAL ON THE HOOF SHOWING LOCATION OF MEAT CUTS

1, hind shank; 2, round; 3, rump; 4, loin; 5, flank; 6, prime rib; 7, navel; 8, chuck rib; 9, brisket; 10, shoulder; 11, cross rib; 12, fore shank; 13, neck

If the brine shows signs of fermentation in warm weather, it should be drawn off, boiled, strained through a clean cloth, and after it is thoroughly cooled, poured back on the meat.

The meat should be kept in a cool, dark place. At the end of thirty days the meat will be ready for use. If the pieces are larger than six inches square, a longer time may be allowed, according to the size of the pieces.

Pressed corned beef.— After the corned beef, prepared as described, has been in the pickle for the required length of time, it may be taken out, and, after the brine is washed off, may be used in the same way as fresh beef. If desired, it may be made into pressed corned beef. This

is prepared as follows: Remove the beef from the pickling solution, wash it with warm water, and place it in a kettle. Keep it barely covered with water at all times, and boil it for two hours. Salt and pepper may be added while the meat is cooking, but usually there is enough salt in the meat from the brine. Take the meat from the kettle and pack it in pans or in a cold-meat press. Strain the broth through cheesecloth or muslin several times, replace it on the stove, boil it down to one-half its original volume, pour it over the meat in the pans, and allow the whole to harden in a cool place. After the meat has hardened, it may be sliced and eaten without further preparation.

Dried beef.— Dried beef is usually made from the round, although any heavily muscled part may be used for this purpose. The inside of the round makes the tenderest meat. In cutting meat for dried beef, the muscles should be separated into their natural divisions. When cured and smoked in this way they can be sliced across the grain, and the meat is much tenderer than would otherwise be the case.

A jar or a barrel is the best receptacle in which to pack the meat when curing it. To each 100 pounds of well-cooled beef weigh out 6 pounds of fine salt, 3 pounds of granulated or brown sugar, and 2 ounces of saltpeter. Mix these thoroughly, without wetting, and divide the mixture into three portions. Set two portions away for future use, and rub the other portion into the meat. Pack the meat in the jar and leave it for three days. At the end of the three days take the meat from the jar, but leave in the jar the sirup that has formed. Rub the meat with another portion of the mixture, repack it, and leave it for three days. Remove it from the sirup, rub it with the last portion of the mixture, and repack it in the sirup in the jar. After three days remove the meat and hang it in the smokehouse, where it should be smoked until it is dry. It should then be kept in a dry place until it is used. The longer it is smoked and the drier it is kept, the longer it will remain good.

SUGGESTIONS FOR TEACHERS

It is suggested that when using the lesson on beef the teacher take the class to a meat market or to a farm where a carcass can be seen, and have the cuts of meat pointed out on the carcass itself. The average butcher will be glad to explain the method of cutting and to show the students the various cuts of meat, because he realizes that a more thorough knowledge of meat among his patrons means increased business.

In case it is impossible to bring the students in touch with the meat itself, it is advisable to show them the cuts in their natural position on the live animal. This can be easily done by visiting a farm where a quiet animal of some solid dark color can be procured and the cuts marked on the body with chalk. (See illustration on page 107.)

ANIMALS TO BE RECOGNIZED IN 1917-1918

A. H. Wright
Assistant Professor of Zoology, Cornell University

GOAT

The goat is closely related to the sheep, its horns rising from the forehead and curving backward, but not forming a spiral as do those of the ram. It is covered with hair of varying length, and the male has a beard. The legs are strong, though not large, and are fitted for leaping and running. The tail is short, like that of the deer. Our Rocky Mountain goat is not really a goat, but belongs to the antelope group. It is twice the size of any true goat, and is white, with long, shaggy hair.

PHOTOGRAPH BY THE U. S. DEPARTMENT OF AGRICULTURE

ANGORA GOAT
About one-fifteenth natural size

The goat plays a prominent part in family life in Europe and Asia, but in America there are relatively few of these animals. They are raised more extensively in the South and the West. In this State there are perhaps not more than two thousand.

There are many kinds of goats, chief among which are the Milch, the Angora, and the Cashmere. The Swiss farmers have a very high type of Milch goat, which is a source of considerable revenue to them. In the winter these goats are kept in shelters and fed, but in the early spring they are sent to grazing grounds. They browse over great stretches of land. When properly cared for and kept clean, their milk is excellent and very nutritious. The butter is inferior, but many particularly choice cheeses are made from their milk. There are almost none of these animals in America, although there is no reason why the raising of goats should not prove a profitable industry.

The Angora goats first came from Angora, a city in Asia Minor two hundred miles southeast of Constantinople. Their fleece is long, silky, and curly. Most of the mohair for mohair, alpaca, and camel's-hair

goods is produced by these goats. Their skins are rather delicate, being used mostly as rugs or robes or for trimmings. Morocco leather also is made from their skins. Many flocks of these goats are raised in this country. Besides their intrinsic worth, they are especially helpful in clearing out underbrush, being very fond of leaves and twigs as food.

The Cashmere goats are raised mostly in Tibet. Their wool is long, silky, and straight. It is from this wool that the famous Cashmere shawls are made. It takes the wool from ten goats and the work of several persons for a year to produce one of the shawls.

The common goat is of the mongrel type; it will live anywhere and on very little food. The milk is good, but small in quantity. It is a question whether this goat could be raised with profit on a commercial scale.

FOX

The common fox of this State is the red fox, although the gray fox occurs to a slight extent in the southeastern part. The predominant color of our common species is reddish, as the name implies; feet and ears are blackish; tip of tail, white. The ears are about three inches long. Three distinct color variations of the red fox are found, together with many intermediate forms. The cross-fox is like the red, but with a dark cross on the back of the neck. The silver fox is entirely silver-gray. The black fox is blackish.

In character the fox is bold to the point of recklessness, and very wild. He seems to scheme and lay plots to outwit an enemy and is very quick in learning to avoid danger. He apparently loves hunting, enjoying the excitement of the chase even though he does not catch anything. His sense of hearing is so keen that he depends largely on it in this sport. Reynard's weakness for poultry is a source of much trouble to farmers. He often carries away his booty with its neck between his teeth and the bird swung across his shoulder.

These shrewd animals have established runways that seldom pass between houses less than one-half mile apart, but that always cross streams over the bridges. The footprints of a fox show four toe pads of equal size, with distinct marks of the claws in front of them — differing from the cat, whose claws are concealed; the prints differ also in that the hind foot does not fall in the footprint of the forefoot as does that of the cat. Unlike the dog, the toes seldom drag, the feet are set in a straight line, and the tail occasionally brushes the snow.

Foxes live in dens, which are usually abandoned woodchuck burrows in a sandy hillside, enlarged to suit the new occupant. The male seldom enters the den save to carry food to the cubs. He prefers to sleep on a flat rock or ledge in the open, occasionally choosing a hollow tree trunk.

The bark of the fox is thin, querulous, and husky, with an occasional long wild screech included, the latter being heard in the spring when there are young to be protected.

The gray fox is a wholly distinct species. He is smaller and of different build, dull yellowish gray, and usually lacks the white tip on the tail. He is distinctly a creature of the forest, preferring to live in hollow logs or tree trunks, subsisting on the small creatures of the forest and at times on the fruits found there.

PHOTOGRAPH BY VERNE MORTON

SKUNK NEAR ITS BURROW

About one-twentieth natural size

SKUNK

The skunk is about two feet long. His typical marking is his covering of long black hair, with a white patch on the back of the neck from which two stripes extend down the back and along the sides of the very large and bushy tail. There is a thin white stripe down the forehead. Some animals have much less white than others, and some have the two white stripes uniting to form a broad band down the back.

The skunk prefers to live in clearings and pastures near houses, under one of the farm buildings, or in some dry hole not far distant. He travels mostly at night and so is seen only at dawn or in early evening. He catches quantities of mice and insects, thus doing the farmer much more service than the loss that results from stealing a few eggs and chickens. He also delights in salamanders, frogs, and the eggs of birds that nest on or near the ground.

The characteristic most closely associated with this animal is beyond doubt his "odoriferous gun." This comes from a fluid secreted by large glands just under the tail, with ducts ending in papillæ that can be protruded and directed as the owner desires. Although armed with so wonderful and effective a weapon, the skunk is very conservative in its use, employing it only in defense and then giving fair warning by his actions and by raising his tail. With provocation, the spray can be thrown ten feet. At night it is slightly luminous. It is perhaps because of the effectiveness of this weapon that skunks have abandoned the agile ways of their brothers, the weasels and the minks, and have become fat, lazy,

and slow in their movements. These characteristics are certainly seen in their tracks. In general, the track consists of a double line of footprints, which are about the size of those of the domestic cat and about half as far apart. The toenails, however, form conspicuous and characteristic marks. When the animals hurry, the footsteps are often in groups of threes or oblique rows of fours. Skunks hibernate only in the severest months of the winter, coming out whenever the temperature allows, regardless of the amount of snow on the ground.

MUSKRAT
About one-tenth natural size

The young are born about the end of April or the first of May, four to six, or even ten, in a litter. They are about the size of a mouse, naked, and with their eyes and ears closed. They stay with the parents through the first winter even though full grown, so that eight or ten skunks of one family are frequently found in one den. Each goes out for himself in the early springtime. Young skunks are easily tamed, making very attractive and interesting pets. They are easily caught in a trap or by digging out a den.

The flesh of the skunk is commonly eaten by Indians and trappers and is said to be white and of delicate flavor.

MUSKRAT

The muskrat is two feet long, its color a rich dark brown above, grayish below, with the sides and belly tinged with rust color. The body is thickset, the legs short, the tail scaly, nearly naked, and flattened laterally. The fur is thick with woolly underfur. The skins supply a very good quality of fur.

Muskrats live in and near water except in the early fall when they may wander several miles from their accustomed habitat. They are excellent swimmers and divers. They build elaborate homes and seldom travel more than two hundred yards from them. In their travels the tail trail makes their tracks conspicuous. The footprints are arranged in a zigzag line, with the toes quite distinct. When the animals are alarmed, the footprints are in a pattern something like those of the rabbit.

The homes of muskrats are of two kinds, huts and burrows. The huts are used in winter, the burrows at all times. The entrance to the burrow is below the water level and from this a path leads upward to the den, some distance inland and often very near the surface. Several galleries may lead away from this chamber and there may be several passages leading to it. It is by the caving in of these burrows that the damage is done to fields, dams, and levees. The muskrat hut is started in the water, where a small "haycock" of vegetation and mud is piled up. The top is well out of water and contains an air chamber, from which

MUSKRAT HUT

one or more pathways lead downward. This dome is built largely of plant stems and roots that the animal eats in winter. During the winter the muskrats are very active, swimming around, coming to the edge where there is air space to breathe, or, when the ice is close to the water, merely

rising to the surface, exhaling their bubble of air against the ice, and then taking it again refreshed by contact with the freezing water. Throughout the year they live largely on marsh grasses and aquatic plants, but occasionally they eat fish and water mussels also.

Although these animals are so diligently hunted and trapped, their number is maintained because thay are so prolific. Five to nine young are born at a time, and they are said to raise three litters a season, the young maturing very rapidly.

The mink and the great horned owl are the worst natural enemies of the muskrat.

FROG

Material on frogs was given in the September 1916 leaflet on page 95, to which reference should be made in taking up the topic this year.

ANIMAL QUOTATIONS

COW

Into the yard the farmer goes,
With grateful heart at the close of day:
Harness and chain are hung away;
In the wagon-shed stand yoke and plough,
The straw's in the stack, the hay in the mow,
The cooling dews are falling; —
The friendly sheep his welcome bleat,
The pigs come grunting to his feet,
And the whinnying mare her master knows,
When into the yard the farmer goes,
His cattle calling,—
" Co', boss! co', boss! co'! co'! co'! "
While still the cow-boy, far away,
Goes seeking those that have gone astray,—
" Co', boss! co', boss! co'! co'! "

From *Evening at the Farm*
by JOHN TOWNSEND TROWBRIDGE

MUSKRAT

Over in the meadow,
In the reeds on the shore,
Lived a mother-muskrat
And her little ratties four.

" Dive!" said the mother;
" We dive," said the four:
So they dived and they burrowed
In the reeds on the shore.

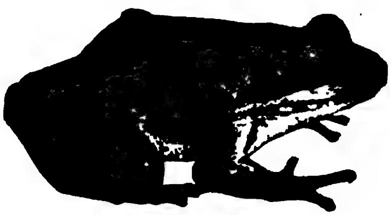
From *Over in the Meadow*
by OLIVE A. WADSWORTH

FROG

Said a little black Tadpole to another,
That happened to be his elder brother,
" Pray, what strange creature is that I hear
Croaking so loud?" " A Frog, my dear,"
Said the brother, " and there he sits." " I ne'er
Saw an uglier monster, I declare,"
Cried little Taddy, wriggling his tail,
In an offhand fashion that could not fail
To show his contempt. " It's really a pleasure
And satisfaction, no words can measure,
To think that *we* are so smooth and slim,
So handsome, so — *very* unlike *him*."
" To be sure," said his brother, bobbing and blinking,
" To be sure, I'm just of your way of thinking."
The air was mild and the sun was strong,
The Tadpoles were turned to Frogs ere long;
The little one croaked, the big one croaked.
At last said the younger, " Of course, we — joked
That day in the ditch; for there's no denying,
And in fact it's a truth past all replying,
That whether in mere or marsh or bog,
The handsomest creature, by far, is a frog."
"To be sure," said his brother, bobbing and blinking;
"To be sure, I'm just of your way of thinking."

*Turncoats**
by THOMAS WESTWOOD

* **Reprinted by courtesy of Little, Brown, and Company.**



INSECT STUDY

THE EDITOR

NEVER do children cease to marvel at the transformation that many insects undergo, and at the multitude of forms of life that abound in the insect world. It is a source of endless interest and possibilities for active work and study.

Every teacher should become familiar with the stages of the complete insect metamorphosis, which involves the four phases of the egg, the larva (which is usually the feeding stage), the pupa (which is the quiescent stage), and the adult. The fact that many insects go through such periods of change, in other words, that they have a life history, is important oftentimes in controlling injurious species. This will be apparent from the study of some such insect as the potato beetle or the apple-tree tent caterpillar for usually at some one stage in its life the insect is most vulnerable, and can most readily be controlled.

Teachers should also have very clearly in mind the distinctions between moths and butterflies, which have been given in the leaflet every year heretofore. Letters are still received that speak of butterflies emerging from cocoons, and that use the terms *moth* and *butterfly* interchangeably. This is a simple thing, but it is fundamental, and can easily be made clear to the youngest child.

The list of insects given for study during the coming year includes the potato beetle and the lady beetle, together with one biting and one sucking insect for special study. The potato beetle and the lady beetle are readily available and are especially interesting because of the relations between them at various points of their life histories. The potato beetle is injurious, while the lady beetle is beneficial and aids in the destruction of the potato beetle. In former years the leaflet has contained material on several insects with biting mouth parts and on several with sucking mouth parts, in order to meet the varying conditions in schools by offering a choice. Owing to lack of space it is only possible to present one insect of each type this year. Teachers should of course feel free to study any others that are available. The flea beetle and the squash bug have been chosen because of their relation to other topics in the Syllabus list this year, and because they are common and important.

The list of insects for recognition includes, besides the potato beetle, the apple-tree tent caterpillar, the honeybee, the ant, and the hornet.

The spider is also given in the list in the Syllabus, probably because it could best be included at this point although of course the spider is not, strictly speaking, an insect, there being essential differences that are made clear in the article on spiders. As many teachers and pupils know, much work was done several years ago in controlling the ravages of the apple-tree tent caterpillar. The pest is not so serious at the present time, although there are always some egg clusters and nests to be found. The honeybee, the ant, and the hornet were given for study last year, and full information in regard to them may be found in the September 1916 leaflet. Spiders abound everywhere.

In connection with the insect work a terrarium is invaluable, and attention is called to a report from a teacher given on page 23, which mentions many interesting ways in which a terrarium can be used.

It is also possible to have in the schoolroom an ants' nest, which was described on page 121 of the September 1916 leaflet.

Some schools have been able to obtain an observation beehive, and few things can be of greater interest and value to the children than to follow closely the habits and activities of a colony of bees. Mrs. Comstock, in her article on the honeybee in the September 1916 leaflet, discusses the use of the observation hive.

Since many insects are serious pests to the farmer, it is always well to call attention to the economic phases of insect study, and to the more general agencies and practices that serve to hold insects in check and to prevent their becoming a scourge. Of course children will be interested in the relation between bird life and insect life, and in the service that birds render in this connection. Likewise, the farm practices of spraying, rotation of crops, and keeping roadsides and hedgerows clean to prevent them from becoming breeding places for insects, are all worthy of recognition and of emphasis.

Attention is called again to the fact that it is undesirable for schools to attempt to make general collections of insects. However, a mount showing the various stages in the life history of some injurious insect is very valuable, and a few such mounts might well be prepared during the year. This will serve to maintain the interest because the different stages can be obtained only at different seasons.

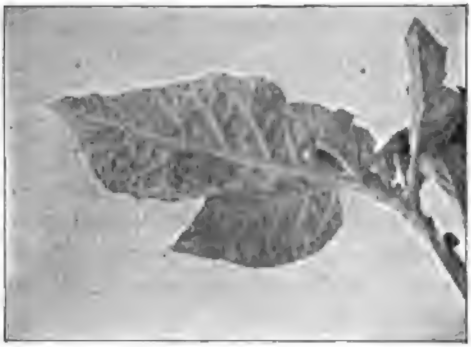
Teachers in the cities are often able to do considerable work in connection with insect study. There is no reason why the activities of the year should be confined to the insects that have been listed in the Syllabus, or why it is vitally necessary that every one of those insects should be covered. The natural opportunities that arise should guide the work to a large extent, but so far as possible those that are indicated for study and recognition by the Syllabus should receive attention.

COLORADO POTATO BEETLE

(For special study)

Glenn W. Herrick
Professor of Economic Entomology

The writer recalls the early days of the "potato bug" in New York State and the tedious method of knocking it off the vines into pans of kerosene. Its advent as a pest on potatoes caused a good deal of consternation and as much discussion as has the San José scale insect on fruit trees. This beetle migrated from its original home in Colorado, where it lived on a wild plant of the potato family, and gradually worked its way eastward from field to field of potatoes until, in 1872, it reached New York. Now it is probably the most familiar insect pest on the average farm. It is no longer seriously dreaded, although it still has to be fought. It not only destroys the vines and lessens the yield of tubers, but actually affects the quality of the potatoes. Where these beetles are abundant on the vines the potatoes are likely to be watery and of poor quality.



EGGS OF THE POTATO BEETLE
Natural size

APPEARANCE OF THE BEETLE

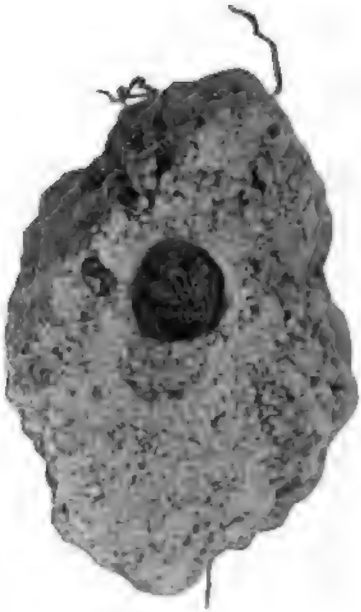
The adult insect is called a beetle because it has two hard, horny wing covers that close over and hide the true thin wings, the chief organs of flight. The beetle is a robust insect nearly half an inch long, and has a ground color of ocherous yellow, almost reddish yellow at times. Each wing cover is ornamented with five black lines running lengthwise. The thorax is marked with ten or more dark spots, while the head is small and bears one dark three-cornered spot.

The mouth parts of the beetle consist of two pairs of jaws, the upper pair being dark-colored, hard, and horny. These enable the insect to bite off bits of leaves and stems, which it chews and swallows.

If one of the beetles is taken in the hand and squeezed slightly, it gives out an orange-colored fluid with a strong odor. The fluid issues from the hind end of the thorax and the front parts of the wing covers. It is probably distasteful to birds and may aid in protecting the beetles from their enemies. The grubs eject a similar fluid.

STORY OF ITS LIFE

In the fall of the year the adult beetles burrow into the ground, where they pass the winter. They usually go below the surface eight or ten inches, but sometimes they are found several feet underground. Occasionally individuals hide away beneath piles of rubbish.



PUPA OF THE POTATO BEETLE IN EARTHEN CELL
Natural size

In the spring the beetles work their way out of the ground very early and during warm days make long flights, so that they are well distributed over the fields and ready for the potato plants as soon as they push through the soil. After feeding a few days, the mother beetles begin to deposit their orange-colored eggs in clusters on the leaves. The eggs hatch in a week or ten days, depending on the temperature, and the young grubs begin at once to eat the leaves. The grubs have soft, red bodies, with two rows of dark spots along each side. They also have biting mouth parts and are always apparently very hungry. They eat most of the time, grow very fast, and become full grown in two to three weeks. When mature they go to the ground and burrow beneath the surface, where each one makes a snug cell in which it soon changes to a pupa. The pupa remains in its cell for two weeks or longer and then transforms into the adult beetle. These beetles come out of the ground and lay eggs for a second generation, which usually is the last one for the season.

FULL-GROWN LARVÆ OF THE POTATO BEETLE
Natural size

NATURAL ENEMIES

Most persons have no idea how often they are aided in their fight against insect pests by birds, toads, ladybird beetles, flies, wasplike parasites, and other helpers in the struggle. The enemies of the Colorado potato beetle are many.

Perhaps the most efficient of them are the ladybird beetles. At least eight different kinds of ladybirds attack and destroy the potato beetle in some of its stages. Every one should become acquainted with these ladybirds so that they may be protected if possible, and certainly not destroyed. Both the adult ladybirds and their larvæ feed on the eggs and grubs of the potato beetle and destroy great numbers of them.

ADULT POTATO BEETLES
Natural size

There are also several kinds of rather large, dark-colored beetles, known as ground beetles, which prey on the potato beetle and its grubs.

A certain fly, called a tachina fly, lays its eggs on the grubs. The eggs hatch and the maggots bore through the skin of the grub and live inside its body, finally killing it. It is said that the tachina flies are sometimes so abundant in fields of potatoes that their buzzing sounds like a swarm of bees. These flies must aid greatly by killing many of the potato beetle grubs.

Toads and snakes devour many of the potato beetles and help greatly in the fight. Birds, too, join in the good work, especially the rose-breasted grosbeak and the bobwhite, or quail. Robins, crows, nighthawks, cuckoos, and other birds also destroy potato beetles.

METHODS OF CONTROL

Since both the beetles and the grubs have biting mouth parts, they are best destroyed by spraying the potatoes with an arsenical poison.

The substance most commonly used is paris green, a very strong poison, and one that is likely to burn the leaves unless quicklime is added to it. It should be used at the rate of 1 pound to 50 gallons of water, with 2 or 3 pounds of good quicklime carefully slaked and added to the water.

Potatoes are subject to the disease known as blight, and most potato growers spray their plants with a fungicide known as bordeaux mixture to control this disease. It is not necessary, however, to make separate sprayings for the blight and for the potato beetle, since by combining the paris green with the bordeaux mixture, 1 pound to 50 gallons, both objects may be accomplished. In this case, because the bordeaux mixture is largely composed of lime, it will not be necessary to add more of this material.

A SEVEN-ROW TRACTION SPRAYER AT WORK

Some potato growers prefer to apply the paris green dry by mixing it thoroughly with 10 to 20 parts dry flour or fine air-slaked lime. Others actually dust the pure poison on the plants in the early morning while the dew is on the leaves. The dust is best applied by means of a powder gun or "dust-spray" machine. In case the pure paris green is used, only a small amount of it should be dusted on the plants because it is likely to burn and kill the leaves.

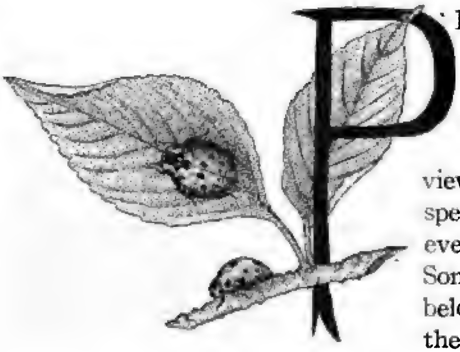
The first spraying should be made as soon as the eggs begin to hatch and the young grubs are seen on the plants. In severe cases two applications, a week or ten days apart, may be necessary.

Arsenate of lead is also a much-used poison for biting insects and is often applied to control the potato beetle. It sticks to the plants much better than does paris green, but, since it is a weak poison, more of it has to be used. The best results will be obtained by using it at the rate of 5 or 6 pounds to 100 gallons of water or of bordeaux mixture.

LADY BEETLES

(For special study)

Anna Botsford Comstock
Assistant Professor of Nature Study



PERSONS who do not know about the small brothers of the fields have an idea that all insects are injurious to human interests. This, however, is a very unjust view; there are many insects that spend their whole lives doing us favors, even though we show no gratitude. Some of these beneficial insects belong to the family of ladybirds, as these small beetles are called. In fact, all except one or two members of this family are very friendly indeed to the gardener, the fruit grower, and the farmer; for instead of feeding on plants, they feed on the plant lice and the scale insects that infest plants.

The ladybirds, or ladybugs, are small beetles that look like pills of various sizes cut in half with legs attached to the flat side. Some species are brownish red with black spots; some are black with reddish or yellowish spots. Throughout the land, whenever a country child sees one of these ladybird beetles, he addresses it thus:

> " Ladybird, Ladybird, fly away home,
> Your house is on fire, your children are burning."

But the ladybird is not at all frightened at this piece of news, because she does not know where her children are, and I am afraid she would not know one of them if she met it. She performed her last duty to her family when she laid a cluster of yellow eggs on the underside of a leaf of some plant infested with plant lice or scale insects. From each one of these eggs hatched a little creature that is very different in appearance from its mother. It is a long, rather flat, velvety creature, covered with warts and short spines and black or brownish black in color, ornamented perhaps with some bright-colored spots. It moves around briskly on six stiff little legs, one pair to each of the three segments of the body next to the head. The first thing this little creature does is to hunt for a stupid plant louse or scale insect and promptly seize it with strong jaws and chew it with great gusto, not leaving even a leg to tell the tale. A great many of these insects must share a like fate before the larva ladybird grows enough so that its skin is too tight for comfort. When this occurs

the old skin is shed and a new skin takes its place, giving the greedy youngster plenty of room, so that it starts on a new crusade against the plant lice and then repeats the process. At last, when it is perhaps half an inch long, some day it hangs itself up and sheds its old spiny skin and changes into a queer little spotted pupa. Here it hangs, still and helpless, for some days, and then the pupa skin bursts, and out comes a little hemispherical ladybird, which may soon be ready to lay more eggs. Or, if too late in the season for this, she may seek a cozy nook in which to pass the winter. We often find her in the curtains about our windows, and we should be very careful not to harm her; instead, we should cherish her and let her out when spring comes, so that she can go on helping us. The help the ladybirds give us is all the more valuable because both plant lice and scale insects have mouth parts in the form of a sucking tube, which is pushed down into the stem of the plant, thus reaching the sap and sucking it up, injuring the plant. Spraying the plants does not inconvenience these insects at all, because they never get a taste of the poison applied to the outside of the plant.

If we look at a ladybird carefully we can see that she has attached to her head a pair of short, clublike antennæ. Behind the head is the thorax covered with a shield, which is broader toward the rear and is ornamented in various patterns. The head and the thorax together occupy scarcely a quarter of the length of the insect, the remainder consisting of the half-globular body encased in polished wing covers. Below these wing covers is a long pair of dark wings, which are folded crosswise when at rest.

The ladybird is a good flyer as well as a rapid runner. One of the greatest achievements of economic entomologists was the introduction on the Pacific Coast of a ladybird from Australia, called the vedalia, which preys on the cottony-cushion scale insect, a species of insect introduced from Australia also and very injurious to orange and lemon trees. Within a few years the introduced ladybirds had completely exterminated this pest.

LARVA, PUPA, AND ADULT OF A SPECIES OF LADYBIRD
About one and one-half times natural size

SUGGESTIONS FOR STUDY

The ladybird beetles are very common in the autumn and may then be brought to the schoolroom for the children to observe. As many species as possible should be collected. The ladybird larvæ may be found on almost any plant infested with plant lice. A plant with the insects on it may be brought into the schoolroom and studied.

Questions that may be used to guide the children in making their observations and to quicken interest are as follows:

1. How large is the ladybird? What is its shape?

2. Describe the colors of your ladybird. How many kinds have you seen?

3. Can you see the ladybird's head and antennæ? Can you see, back of the head, the thorax covered with a shield? How is this ornamented?

4. What are the colors of the wing covers? How many spots are there on them? Describe the position of the wing covers when the ladybird is flying. Where does the ladybird keep her true wings when at rest? Describe the wings.

5. Note the legs and feet and describe them. To what part of the body are the legs attached? Is the ladybird a good runner?

6. Describe how a ladybird plays possum when disturbed. Of what use is this to the insect?

7. Describe a young ladybird. Does it look like its mother? What is its shape? Is it polished like its mother, or is it warty and velvety?

8. How does the young ladybird act when eating? Can you see how it uses its jaws when eating? Describe its legs. Is there a claw at the end of each foot?

9. Describe the action of the ladybird larvæ in attacking and eating plant lice or scale insects.

10. Describe how a ladybird larva grows by shedding its skin.

11. Feed the larva by placing it on fresh plants covered with plant lice, and note its growth. What happens when it changes into a pupa? How does it look when in the pupa state? What happens when the pupa skin bursts?

12. Where do the ladybirds spend the winter? Why should we take good care of them?

BITING AND SUCKING INSECTS

GLENN W. HERRICK
Professor of Economic Entomology

NAME OF INSECT	MOUTH PARTS
Potato flea-beetle	Biting
Common squash bug	Sucking

POTATO FLEA-BEETLE

The potato flea-beetle is one of the principal insect enemies of Irish potatoes in this country. It is found from Maine to California, and because of its injuries has attracted enough notice to have been mentioned in bulletins from over half of the experiment stations of the United States.

Not only does the flea beetle injure the plants directly, but evidence has been gathered to show that the foliage punctured by the beetles is more readily attacked by the disease known as early blight than are the normal uninjured leaves. The holes made by the beetles in the leaves appear to serve as points of entrance for the fungus causing this disease. In addition to this the beetles themselves are suspected of carrying the spores of the blight fungus from plant to plant and thus becoming active agents in distributing the disease over a field of potatoes. Therefore the potato flea-beetle is doubly dangerous and should be fought doubly hard.

ADULT FLEE BEETLE
Much enlarged

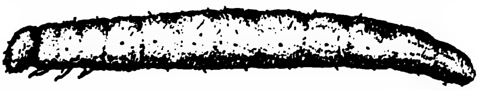
APPEARANCE OF THE FLEA BEETLE

The beetle itself is not well known by potato growers because it is very small, and because it lives mostly on the underside of the leaves. It is only about one-twelfth of an inch in length. Its body is shining black, but its legs and antennæ are dull yellow. The hind legs are especially large and strong and well fitted for jumping. When disturbed, the small beetles leap quickly and vigorously from one hiding place to another, and because of this habit have been given the name flea beetles. The beetles have biting mouth parts and gnaw tiny holes through the leaves.

POTATO LEAF EATEN BY FLEA BEETLE
Natural size

STORY OF ITS LIFE

The small flea beetles pass the winter hidden beneath leaves and rubbish. In early spring they come forth and go to plantain and other weeds, although it is not thought that they feed much, if any, at this time. Later they find their way to young tomato plants and potatoes where they begin to do much damage. During the latter part of June the beetles deposit their very tiny white eggs in crevices in the soil at the bases of the plants. The eggs hatch into small, white, slender, wormlike larvæ that become about one-fifth of an



LARVA OF FLEA BEETLE
Much enlarged

inch in length when full grown. In July and August the larvæ change to pupæ, and the flea beetles of the new generation soon begin to appear, and remain in evidence until the first killing frost in the autumn, when they disappear probably to enter their winter hiding places. Farther south the potato flea-beetle may perhaps have more than one generation a season.

INJURY AND CONTROL

The principal injury is done by the beetles to the foliage of the potato when they swarm on the plant in the spring. They feed on the undersides of the leaves and eat out small circular cavities in the tissue; they never eat clear through the leaves, however, but stop just short of the upper surface. Later the upper skin of the leaves dries and breaks away over each cavity, so that finally the holes extend all the way through and the leaves appear as though riddled by bird shot.

In some years and in some localities the small, wormlike larvæ bore straight into the flesh of the tubers in the soil and cause a certain amount of injury. The cells of the potato, stimulated by the pressure of this intruder, harden around the body of each larva, and form what potato growers call "slivers." In addition to this, tiny scars, known as "pimples," are formed on the skin of the tubers around the entrances of the larvæ. Pimply and slivery potatoes are common in some seasons especially on Long Island, and buyers will take them only at a reduced price.

It has often been said that the flea beetle cannot be poisoned. This, of course, is not true. Nevertheless experience and experiments have shown that the potato flea-beetle cannot be controlled by spraying potatoes with paris green or other poison as is done for the Colorado potato beetle. The reason for this seems to be that the beetles avoid the poison by feeding on the parts of the leaves left uncovered by the spray, especially on the undersides. Undoubtedly a few of the beetles are killed by a thorough poison spray but not enough to hold them effectively in check.

The most effective substance that has as yet been found for this enemy of the potato is bordeaux mixture. Fortunately bordeaux mixture is also a remedy for the early blight of potatoes. Therefore these two enemies of the potato may be controlled with the same mixture and effort. It must be remembered that bordeaux is not a poison for the beetle but rather a repellent, and to obtain success it must be sprayed on the plants thoroughly in liberal quantities and at frequent intervals. Experiments have shown that at least 100 gallons of bordeaux should be applied to each acre of potatoes, and if other insects are present, arsenate of lead may be added at the rate of 5 or 6 pounds to each 100 gallons. Best success will be obtained by arranging the nozzles, if possible, so that the liquid can

be sprayed onto the underside of the leaves where the beetles are most abundant.

THE COMMON SQUASH BUG

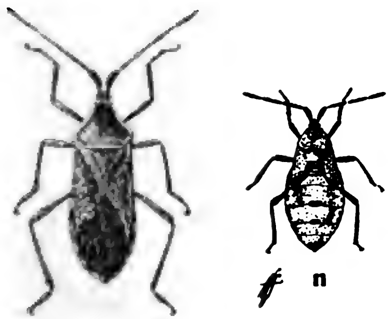
The adult squash bug varies in length from more than half an inch to nearly three-fourths of an inch. It is blackish brown above and specked with yellow underneath. Its head is small and narrow and bears a prominent black eye on each side. Reaching out in front are two long antennæ, the joints of which are long enough to be counted with the naked eye. On the underside of the head is a long, slender beak, which is carried close to the body between the first two pairs of legs. This beak constitutes the mouth parts of the bug, making it, therefore, a sucking insect.

EGGS OF A SQUASH BUG ON A LEAF
Natural size

The beak has a deep groove on the upper side. Lying in this groove are four tiny, threadlike bodies. These have fine, sawlike teeth at their free ends, and are used by the insect to puncture a leaf or a stem. The juice of the plant is then drawn into the mouth of the insect.

STORY OF ITS LIFE

The full-grown bugs hide in the fall beneath stones, boards, leaves, and any rubbish that they may find. In spring they come from their hiding places and begin their search for squash vines. When they find the plants, they soon commence to lay their brown eggs on the underside of the leaves, and sometimes on the upper side also. Occasionally the eggs are laid in regular rows, as shown in the illustration. In eight to twelve days small green-and-black bugs hatch from the eggs. They are somewhat like the full-grown bugs, but without wings and with long legs. They are called nymphs, and each one has a beak with which it punctures the leaf and sucks out the juices. The nymphs grow and shed their skins five times before they become adults. More than a month is usually required for the bug to reach full size.



a n

THE SQUASH BUG

a, an adult; n, a nymph. About one and one-half times natural size

INJURY AND CONTROL

The squash bug punctures the leaf, sucks out the juice, and injects into the leaf a poison that kills the cells and causes the leaf to turn brown and wilt. It also carries a disease from one vine to another that may cause the death of the plants.

Poisons will not kill the bugs, but early in the spring one should keep a sharp lookout for the old bugs and catch them by hand before they lay their eggs. A little later the eggs may also be destroyed.

The bugs may be trapped under pieces of boards, bark, or shingles laid on the ground. The bugs will crawl under these for shelter and may be caught and killed.

INSECTS TO BE RECOGNIZED IN 1917-1918

POTATO BEETLE

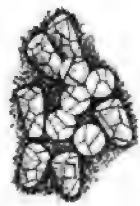
A discussion of the potato beetle is given on page 118.

THE APPLE-TREE TENT CATERPILLAR

ANNA BOTSFORD COMSTOCK
Assistant Professor of Nature Study

The moth of the tent caterpillar is a canny mother and does her best to protect her eggs from their enemies and from the vicissitudes of winter. This is an especially wise proceeding on her part, for she lays her eggs in the summer and they must stay safe and sound until the following spring. She selects an apple twig, and on it she lays her beautiful white eggs, each shaped like a thimble; she arranges them in a mass that encircles the twig, and weaves around them a net of dark, firm cement that holds them in place. Then she covers the whole mass with a waterproof varnish, which protects the eggs from dampness and at the same time makes the egg mass look like a swollen bit of the twig, so as to deceive hungry birds. In fact, few birds, except the chickadees, find these eggs. This busy midget makes it his business to carefully examine twigs in his search for insect eggs, and so he has discovered this mother moth's egg basket.

EGG CLUSTER OF THE TENT CATERPILLAR
Natural size



EGGS OF THE TENT CATERPILLAR
Much enlarged

From these eggs hatch tiny caterpillars with large heads. The first thing they do is to have breakfast from apple buds or new leaves; then they climb down the twig, the whole family

together, to the nearest fork of the branch that offers a convenient support for their home, and there they begin to spin their web, or tent. The silk gland is within the body of the caterpillar, but it has its opening near the lower lip, so that the caterpillars seem to spin silk from their mouths; the spiders, on the contrary, have their spinnerets on the rear end of the body. The web of the tent caterpillar is at first a little triangular affair, consisting of irregular sheets of silk between which the tiny caterpillars can be protected from the rain, just as cosily as we are in our tents when we are out camping. There they stay during the nights and on dark and stormy days; only on pleasant days do the caterpillars go out to get their food, which consists of the leaves.

APPLE-TREE TENT CATERPILLARS
Natural size

And wherever he goes each little caterpillar spins a thread of silk so that he has no trouble in finding his way back home. Each caterpillar grows for a time until his stiff, horny skin is too tight for comfort. He then retires into the web and sheds the old skin, and afterward goes back to his business of eating in a new elastic skin that gives him plenty of room; but this, too, hardens and in turn must be shed, for this is the way all young insects grow. Each time the new skin may be a little different in color from the old one.

The tent caterpillars are social insects and always live together in peace and harmony. As they grow they enlarge their tent until it is sometimes two feet or more in length. Finally, when fully grown the whole band scatters and each for himself finds a place in which to pass the pupa state. At this time any one who is unprejudiced must admit that the tent caterpillars have beautiful colors. They are velvety brown, spotted with purple and yellow, and have a most ornamental fringe of "whiskers" along each side of the body. They have six true legs, one pair to each of the three segments of the body behind the head. Each of these legs has a sharp, shining claw at the tip. These true legs are used often for holding the leaf in place while the caterpillar eats; meanwhile, he holds himself to the branch by four pairs of fleshy legs with hooks on them, which extend down from the sixth, seventh, eighth, and ninth segments, counting from the head. And, lest he fall off, he has on the last segment of the body a clasping foot, called the prop leg. On each side of each seg-

ment, except the first, there may be seen a breathing pore, or spiracle, through which air is drawn into the insect's body to purify the blood.

MOTH OF THE APPLE-TREE TENT CATERPILLAR
Natural size

The fully grown, uneasy caterpillar finally finds snug quarters on the underside of some board or stone, and there it spins a thick cocoon, shaped like a slender jug without a handle. The silk of the cocoon is white and with it is mixed a yellowish white powder. Once within the cocoon the caterpillar sheds its skin, and it now appears as an oblong, smooth object, very little like a caterpillar in shape. This is its pupa state, and during this time it develops within itself its wings and various other adult organs. In about three weeks the pupa skin bursts open, and the insect crawls from the cocoon, a pretty moth with dull yellowish or reddish brown wings and with two whitish stripes across each front wing. The adult moths usually appear the last of June or the first of July and soon afterward the mother moth lays her eggs.

There are several ways of protecting orchards from the ravages of this caterpillar. Although not the most desirable method, a common way is by destroying the webs with a torch. It is necessary to apply the torch on dark or stormy days, so that the little inmates may be destroyed with their tent. The insect can be controlled by collecting the egg rings during the fall and winter. This is work that boys and girls can easily do and that will make them feel that they are being of service to the community. Of course if there are a considerable number of fruit trees, the most effective method of control is to spray the trees with arsenate of lead, 3 pounds to 50 gallons of water, once after the leaves appear but before the blossoms open, and again after the petals fall.

COCOONS OF THE APPLE-TREE TENT CATERPILLAR
Natural size

HONEYBEE

A complete discussion of the honeybee was given on page 122 of the September 1916 leaflet, at the time that this insect was called for by the Syllabus for special study. Teachers who have come newly into the work, or who for other reasons do not possess the 1916 leaflet, or who are unable to find a copy in the school library may obtain one by addressing a request to the Editor, Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York.

ANT

A complete discussion of the ant was given on page 118 of the September 1916 leaflet.

HORNET

A description of the hornet and its habits was given on page 147 of the September 1916 leaflet.

SPIDERS

Anna Botsford Comstock
Assistant Professor of Nature Study

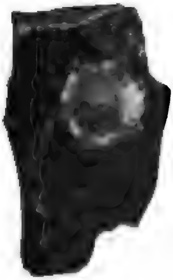
IN the opinion of some persons who are not in the habit of counting what they see, the spider is an insect. This is quite as absurd as calling a rabbit a bird. Any one not blind can see that the spider has eight legs and the insect only six; that the spider has only two parts to its body, while the insect has three — the head, the thorax, and the abdomen —for the spider has its head and its thorax joined. More than this, spiders never have wings. Spiders have two pairs of jaws, similar to the jaws of insects, and in most cases they work sidewise instead of up and down, as do a person's jaws. The first pair of jaws is called the mandibles and the second pair, the maxillæ. Each of the inner jaws, or maxillæ, bears a large feeler, called the palpus. In some spiders these palpi are long, resembling legs, while in the males the tip of the palpus is knoblike in form.

The eyes of spiders are not like the large compound eyes of insects. They are single, each shining like a little gem, and are usually four in number; however there may be but two, or there may be six.

The most interesting of the spider's organs are its spinnerets. These are tiny organs at the tip of the rear end of the body, and on each spinneret are many tiny tubes, sometimes as many as two hundred and fifty, each tube capable of spinning a strand of silk. The silken thread of the spider is indeed most delicate, and yet each single thread is made up of several strands.

The spider's silk is of various kinds and is used for various purposes, as follows:

1. The silk is used to make a protecting sac for the eggs. These sacs vary greatly in appearance. One is jug-shaped and as large as a marble, and is suspended by silk in the tops of weeds; this is the sac of the large yellow-and-black spider that makes its orb web in the bushes in fields. Some spiders make globular egg sacs and hang them on lines of strong silk in bushes; others build soft, yellow, downy sacs under stones or boards or in other protected places; while a very common spider of the fields, which does not make a web at all, spins a shining egg sac attached to stones. This sac is flat, circular, and silvery in color and is not so large as a ten-cent piece. In all spiders' egg sacs there are placed many eggs, and in the case of some observed the stronger spiderlings within the sac devour their weaker brothers and sisters — a fate which the latter seem to take calmly, as if it were a perfectly natural proceeding. Thus, from a nest containing originally five hundred, perhaps not more than forty or fifty spiders emerge.


EGG SAC OF A COMMON SPIDER FOUND ON STONES IN FIELDS
Natural size

2. Spiders use silk as a means of getting about in the air. If a spider's web is disturbed, the spider drops to the ground, extending as it goes a line that keeps it from falling; and as soon as all is well, it climbs back up its rope ladder and returns to the net. If a spider wishes to make a bridge from one point to another, it spins a sticky thread that floats away on the breeze; as soon as it touches something, it sticks fast, and the spider pulls in the slack, making the line tight, fastens it, and thus has a bridge along which it can pass at will.

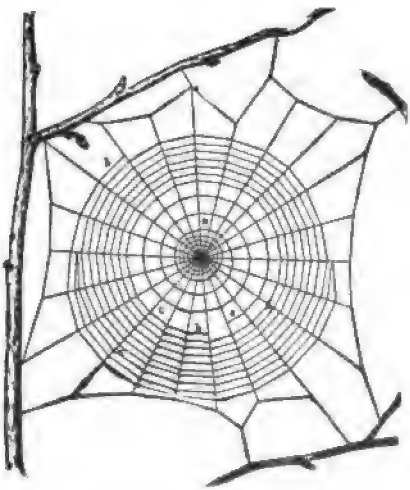


DIAGRAM OF AN ORB WEB

But the young spiders have a more wonderful way of traveling than this: After one of these little creatures is large enough to get about, it climbs to some elevated place, such as the tip of a grass blade, lifts the end of its body, with the spinnerets high in the air, and spins out a thread that the breeze catches and carries upward. When the thread is long enough to support the tiny spiderling, it lets

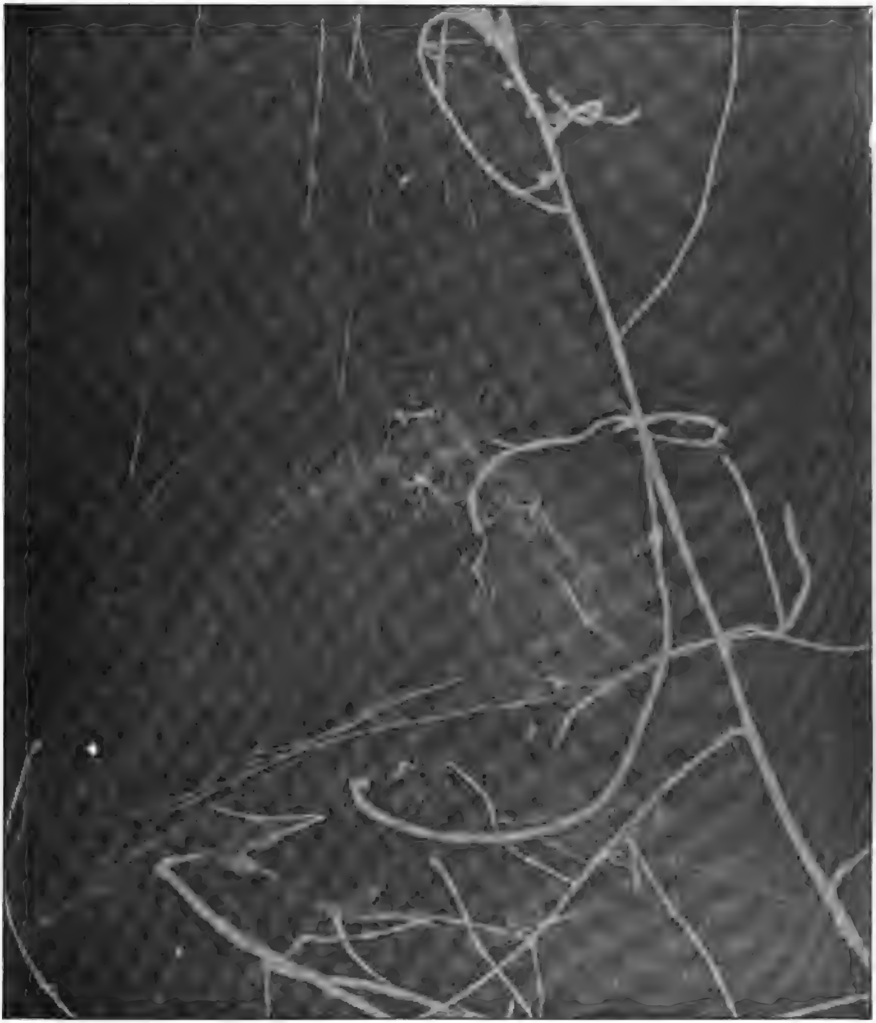
go its hold and sails off attached to its silken balloon. Thus young spiders are scattered far and wide, as are dandelion or milkweed seeds, carried by silken balloons; but the spider's balloon is likely to be just one long thread. Often these threads become attached to grass and

EGG SAC OF A LARGE ORB WEAVER
Natural size

weeds, and thus on autumn mornings, when the spiderlings are ballooning, the fields may be seen covered with these threads of silk.

3. Some spiders use silk to line their nests and to make tubes, within which they live. In this way the trapdoor spider lines its burrow with silk and constructs the trapdoor and its hinges largely of the same useful material.

4. Many spiders use silk to make snares in which they catch the creatures on which they feed. These snares occur in many forms. A few are as follows: some spiders weave cobwebs in the corners of rooms near the



FILMY DOME
About two-thirds natural size

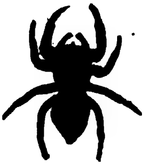
ceilings, each consisting of a sheet of silk supported by many threads; the grass spider weaves a sheet of silk out on the grass and constructs a little tube at one side, in which it hides; another spider builds a filmy

dome, a very delicate sheet of silk shaped like a half-bowl inverted, which it supports by lines attached to shrubs and bushes; but the most wonderful of all these snares are the orb webs, the most perfect structures made by living creatures, except by the hand of man. Each species constructs its own kind of orb web, but the general plan is similar. The spider first constructs the framework of the supporting lines; the outer part of this framework is irregular and holds the web in place, but the central

WEB OF THE GRASS SPIDER
About one-fourth natural size

part is very regular, being constructed like a wheel with many lines radiating from the center. All of the threads of the framework are dry and will not adhere to anything that touches them, nor will they stretch. But after the wheel framework is constructed, the spider places on the radiating lines a spiral thread, which is sticky and elastic so that it will adhere to and entangle any insect touching it. Many of the orb weavers spin a zigzag ribbon across the center of their webs to make them stronger. Some species reside at the center of the web, while others have a retreat near the edge of the web. But, in either case, the resting spider has in

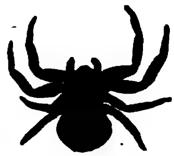
its claws one or more lines connected with the web, and through them receives warning when an insect is entrapped and jars the net. One of the most interesting observations to be made in the field is to watch a spider construct an orb web. This may be seen early in the morning or late in the afternoon on summer days.



JUMPING SPIDER

About one and one-half times natural size

It is not desirable that the children handle spiders or collect them, although none of the spiders in New York State are dangerous to handle. All of them when they bite — which they never do unless they are forced to in self-defense — leave some venom in the wound which might occasion some pain, but usually not so much as that inflicted by a bee sting. However, it is not necessary to handle these creatures in order to study them.

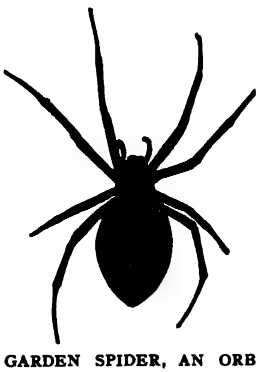


CRAB SPIDER

About twice natural size

THE KINDS OF SPIDERS MOST COMMONLY SEEN

The web weavers.— The web weavers include the cobweb weavers, in the corners of ceilings or cellars; the funnel-web weavers, which spin their sheets of web on the grass; the curled-thread weavers, which spin irregular webs over weeds and flowers, especially the goldenrod and wild plants; and the orb-web weavers.



GARDEN SPIDER, AN ORB WEAVER

The black-and-gold spider that makes the egg sac shown suspended in the goldenrod. About natural size

The crab spiders.— The crab spiders spin no webs, but lie in wait for their prey. They are crablike in appearance and move backward as readily as forward. They live chiefly on plants and fences; some of the species conceal themselves in flowers, where they lie in wait for the visiting insects. These spiders are colored like the flower in which they hide; they are yellow when in the goldenrod, and white when in the white trillium.

The running spiders. — The running spiders are large, dark-colored, and hairy and are often found under stones and logs or boards. They run very swiftly and thus overcome and capture their prey. They spin no webs, but the mother spider makes a very beautiful globular sac in which she places her eggs, and she often carries this egg sac with her, attaching it to herself by means of her spinnerets.

RUNNING SPIDER CARRYING HER EGG SAC

About natural size

The jumping spiders.— The jumping spiders are of medium size. They make no webs, but spin nests in which they hide in the winter or when laying eggs. They have short, stout

legs, are often gray and black, but sometimes have bright colors. They are remarkable for their powers of jumping. They move sidewise or backward with great ease and can jump a long distance. One of these jumping spiders, "dressed in a suit of pepper and salt," we often find on a windowpane, and if you put the point of a lead pencil within an inch of his face, you are likely to see a remarkably high jump. He regards the moving pencil as a fly, and it is his business on the windowpane to catch flies by jumping and seizing them, as a cat jumps after a mouse.

Much has been said about the bloodthirstiness of the spider; but spiders, like the rest of us, are obliged to eat in order to live, and their ways of securing their prey are no crueler than our methods of procuring chicken or lamb for our tables. To one who has watched the spiders carefully it would seem that, after all, their chief characteristic is patience. They spin their webs and then sit and wait until some unwary insect is entangled, and whole days may elapse before a meal is thus obtained.

INSECT QUOTATIONS

Hurt no living thing:
Ladybird, nor butterfly,
Nor moth with dusty wing,
Nor cricket chirping cheerily,
Nor grasshopper so light of leap,
Nor dancing gnat, nor beetle fat,
Nor harmless worms that creep.

By CHRISTINA G. ROSSETTI

LADY BEETLE

Ladybug, ladybug, haste away home!
Your house is on fire,
Your children will burn.
Dear ladybug, I am sorry for you
If your house is on fire.
Oh, what will you do?

* * * * * * *

I do hope some neighbor
Has saved every one
From the terrible fire.
And ladybug, then,
You can build a new house,
And be happy again.

From *Ladybug, Ladybug*
by C. W. BRONSON

HONEYBEE

Roly-poly honey-bee,
Humming in the clover,
Under you the tossing leaves,
And the blue sky over,
Why are you so busy, pray?
Never still a minute,
Hovering now above a flower,
Now half buried in it!

By JULIA C. R. DORR

ANT

Little ants in leafy wood,
Bound by gentle Brotherhood,
While ye gaily gather spoil,
Men are ground by wheel of toil;
While ye follow Blessed Fates,
Men are shriveled up with hates;

* * * * * * *

How appears to tiny eyes
All this wisdom of the wise?

From *Little Brothers of the Ground*
by EDWIN MARKHAM

SPIDER

A noiseless, patient spider,
I mark'd, where, on a little promontory, it stood, isolated;
Mark'd how, to explore the vacant, vast surrounding,
It launch'd forth filament, filament, filament, out of itself;
Ever unreeling them — ever tirelessly speeding them.

And you, O my Soul, where you stand,
Surrounded, surrounded, in measureless oceans of space,
Ceaselessly musing, venturing, throwing — seeking the spheres, to connect them;
Till the bridge you will need, be form'd — till the ductile anchor hold;
Till the gossamer thread you fling, catch somewhere, O my Soul.

*A Noiseless, Patient Spider**
by WALT WHITMAN

* Reprinted by courtesy of David McKay, publisher.

PLANT STUDY

The Editor

IT IS particularly fortunate that the potato is given for special study during the year 1917–1918. Because of its great value as a food crop, because it is so universally grown and used, and because there are so many different phases that can be developed, it has great value educationally.

The Syllabus calls for the recognition each year of one clover, one grain, and one grass; the plants selected this year are white clover, barley, and redtop. Certainly the first and the last of these may be discovered in any community, and specimens of barley can be grown from seed if it is not ordinarily cultivated in the district. It is not necessary, of course, that these three plants be the ones studied, but a plan has been worked out whereby in the course of the five-year syllabus all of the more important clovers, grains, and grasses are covered. If material on those indicated for this year can be obtained, it would perhaps be desirable to study them specially, although in each case it will be valuable to compare them with other clovers, grains, and grasses.

The Syllabus calls, also, for the recognition of the following: willow, cherry, daisy, marsh marigold, anemone, trillium, partridge berry, black medic, squash, turnip, and pitcher plant. This is a fascinating list, offering a wide variety of wild and cultivated plants, the majority of which should be found in practically every community. Such plants as the marsh marigold and the pitcher plant, however, require particular locations, and may be difficult to find in some places. The black medic is an important plant but often seems to give difficulty. Special search might be made in the district for black medic, and care taken that the children recognize it. The greatest trouble comes from confusing it with yellow, or hop, clover, which, however, is quite different both in general character, size of head, and character of fruit.

Five weeds are given for study as follows: bindweed, purslane, thistle, wild carrot, and pigweed. This is a good list. All these weeds are universally found and are serious pests. Few phases of plant study will appeal to the children and to the community with greater force than weed study, and it lends itself to many different times of the year as the plants go through their various stages. In this connection the study of weed seeds can be introduced, and after having collected the seeds during

the summer and fall, they can be carefully studied during the winter until the children are able to recognize at sight the different kinds in a mixture.

It is impossible to cover in these notes all the opportunities that the study of plants reveals. The range of the plant world is so great and we are so constantly in touch with growing things that there should be no excuse for any one to approach the work other than through first-hand association with the material. Aside from the wild forms, the whole question of gardening is connected with plant study, and opens a range of activity and educational growth for boys and girls that is almost limitless. In this connection attention is called to the article in Part III that relates more specifically to children's gardens.

One of the fascinating things in the plant world is the relationship between various plants and the fact that they are grouped into families. This is a subject of great interest to children; once they are aware of it they will find pleasure and development in tracing the kinships of plants.

Attention is recalled to the very clear, helpful article by Professor Wiegand on page 193 of the September 1916 leaflet, entitled *The Collection and Preservation of Specimens of Plants*. The making of an herbarium is one of the best ways to fix in mind the identity of plants, and herbarium specimens lend themselves readily to exhibit purposes.

It may seem to city teachers that their facilities for plant study are limited, and naturally they are in the sense that the great expanse of field and wood is not so readily available to them; yet there are often parks, and many times gardens are to be found in most unexpected places. There is another thing of special importance, that is, that teachers in city schools are able to grow plants in the schoolroom with reasonable certainty that they will thrive, provided the light exposure is adequate. City schools are heated the week round, and there is not the constant danger that the plants will freeze, which is the reason why it is almost out of the question for plants to be kept in the country schoolroom during the cold weather. With two or three window boxes containing good soil, a city teacher can put boys and girls in touch with a great many different forms of plant life during the year, and give them first-hand knowledge that any amount of reading in books could not duplicate.

Finally teachers are urged to use every opportunity to bring to boys and girls an association with "green things growing" that is based on appreciation and knowledge. The fact that men and animals are dependent, in the last analysis, on the plant world for their existence, should be made clear, but the development of the spiritual nature that comes through contact with the soil and growing forces, is no less important than the economic considerations. Any person who has ever had a garden understands this, and it is an experience that we should not deny to any child to whom it may be given.

POTATO

(For special study)

MANY teachers will find the study of the potato one of the most interesting and profitable that can be undertaken this year. It presents so many different phases and methods of approach, it adapts itself to different seasons, and is of such direct and immediate importance in the lives of all persons that a beginning can easily be made, and the investigation, study, and practical activities can be extended as far as local conditions, time, and relation to other work will permit.

A series of six articles dealing with various phases of the potato adapted to school work are given on following pages. The titles of the articles are as follows:

1. The potato plant
2. Potato growing
3. When to sell potatoes
4. Potato types
5. Improving potatoes by breeding
6. Quality in potatoes

In preparation for potato study with the pupils, teachers would do well to read these articles (even to persons concerned in the most general way, they are of great interest) and, as the reading is pursued, to make note of the suggestions that appeal as most suited to local conditions. It is not to be supposed that any teacher will be able to consider with the children all the different phases presented, and it should be borne in mind that the order in which the articles are given in the leaflet is not indicative of their relative importance for particular schools. What to select for study and when to begin the study should be determined by the teacher's knowledge of the subject, the school, and the community.

It may be pointed out in a general way, however, that certain topics lend themselves most readily to particular seasons. For instance, in the fall there is excellent opportunity to study the methods of harvesting potatoes and to observe, as far as possible, the variation that can be seen as the potatoes are dug. The question of marketing may be investigated, and the general practices of the farmers in the community learned. Perhaps some will be found who store their potatoes in preference to selling them from the field. The results of this should be followed. But the most interesting experience in the fall will be the holding of a potato

exhibit at the school. It can be as simple or as elaborate as desired. In writing of an exhibit that was held a year ago, notwithstanding the fact that the potato was not given for special study, one teacher said:

Last fall in potato digging time we had a potato exhibit. Each pupil brought the largest potato he could find in his father's bin, and another of the size his mother liked for cooking purposes. We had quite a collection. We measured and weighed them and learned the names of the different varieties. The parents were interested as well as the children. I might add that I took potatoes of my father's, also.

Such an exhibit of potatoes, large or small, offers opportunity for a good deal of study over several weeks both preceding the exhibit and afterward. The whole question of potato types and varieties may be investigated and practice gained in recognizing the different types and in learning their relative merits. In discussing the exhibition of potatoes, Mr. Hardenburg, of the Department of Farm Crops, has the following to say:

In preparing variety samples for exhibit, it is never desirable to wash the tubers. Washing tends to obliterate the typical characteristics of the skin and to amplify any imperfections in it. Careful brushing with an ordinary whisk broom will greatly improve the appearance of the sample by removing dirt and at the same time will not alter the characters of the skin.

Five tubers of a given variety constitute a sample. Only those tubers that present the true varietal type should be chosen. In case the true type for the variety in question is not certainly known by the one exhibiting, he may feel reasonably confident in selecting the type representing the average of the mass. Uniformity in the sample is of the greatest importance. This means that all five tubers should be as nearly as possible alike in shape, size, depth and frequency of eyes, and color and texture of skin. Most score cards used in judging exhibits give the highest value to the rating of uniformity. The presence of disease, insect or mechanical injury, or blemishes in any form, while not disqualifying a sample, have a tendency to detract very markedly from the rating. Large size should not be sought for in choosing tubers. Tubers weighing between eight and twelve ounces are most desirable. This is the size most popular on the average market. Most markets prefer an oval, flat potato with few and shallow eyes. However, these latter factors are determined by the variety. In order that a given variety as exhibited may receive due credit for its trueness to varietal type and as a variety desired by the market, the following double standard score card has been devised and is being used and recommended by the New York State College of Agriculture:

	Conformity to varietal type, 100 points		Conformity to market demand, 100 points	
	Perfect	Exhibit	Perfect	Exhibit
Uniformity	20		20	
Blemishes and diseases	15		20	
Shape	15		15	
Size	10		15	
Quality of flesh	10		10	
Depth and frequency of eyes	15		10	
Color and texture of skin	15		10	
	100		100	

In the winter a study may be made of the tuber itself, its relation to the growth and reproduction of the plant, and its uses as food. The quality of different varieties can be investigated and studied and practically demonstrated by cooking potatoes in various ways for the noon luncheon. Likewise, the question of storage of potatoes should be followed, and it would be interesting to keep in touch with prices and their relation to the supply in the light of the discussion in the article entitled *When to Sell Potatoes* (page 150).

When spring comes, the growing of potatoes may be discussed, and if possible some of the pupils should be encouraged to grow a patch of potatoes. All the boys and the girls may enter into plans for this. The discussion of soils, methods of planting, cultural practices, spraying, and the like, may be carried on, and a very practical lesson can be gained by visiting a farmer when he is treating his seed potatoes as a preventive against disease.

Perhaps the most valuable and interesting of all the phases of potato study would be the carrying out of a demonstration of the tuber-unit method of improving potatoes, which is outlined in the article *Improving Potatoes by Breeding.* The directions for this work are so simple that any one can follow them who will exercise thought and care. Probably very few schools have grounds suitable for carrying out such a demonstration, although it is possible that in individual cases there might be ground enough of proper fertility, and arrangements could be made with children who live near to care for the plot during the summer. A much better plan in most cases would be to have the demonstration on some home farm where one or more children could be responsible, and where the various operations of culture, spraying, and the like, could be facilitated by the use of the farm equipment. Some school may go so far as to carry this tuber-unit improvement demonstration for several successive years, thus realizing very apparent and profitable results, for the tubers produced could be disposed of for seed purposes at a good price.

All in all, there are tremendous possibilities for the use of the potato in the education of boys and girls. This, of course, is especially the case in the open country, but a number of the phases that have been discussed might be carried out with good results even in cities, such, for example, as the potato exhibit, the study of the tuber for both type characteristics and quality, the methods of cooking, and the questions of storage and price.

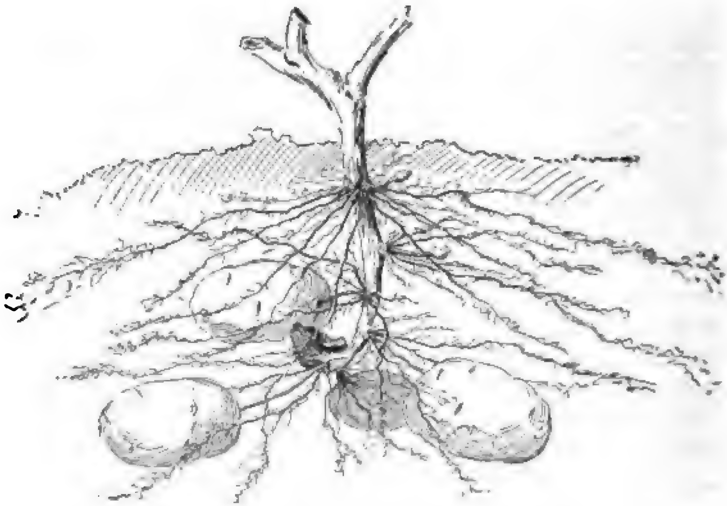
It was originally planned to include with the other articles on the potato, one on potato diseases and one on methods of cooking potatoes, but the necessity to economize space caused them to be withdrawn. Teachers are urged to write to the Office of Publication, New York State College of Agriculture, Ithaca, New York, for Experiment Station Bulletin 283,

The Control of Insect Pests and Plant Diseases, and for Cornell Reading Course Lesson for the Farm 112, entitled *Potato Growing in New York*. In these there will be found material on potato diseases and the methods of spraying and treating seed. Cornell Reading Course Lesson for the Farm Home 81, entitled *Potatoes in the Dietary*, contains a discussion of the food value of potatoes and also many recipes that will be especially useful in connection with noon lunches at the school.

THE POTATO PLANT

K. M. Wiegand
Professor of Botany

Botanically the potato belongs to the nightshade family, which also includes such well-known plants as tomato, tobacco, eggplant, jimson

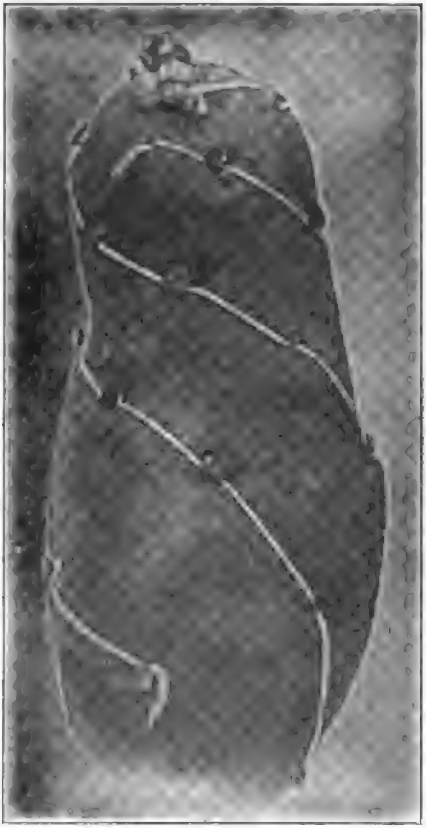


UNDERGROUND PART OF POTATO PLANT IN MELLOW SOIL
Reduced in size

weed, nicotiana, nightshade, chili and cayenne peppers, and petunia. The plant is characterized by an herbaceous stem bearing alternate pinnatifid leaves with rather distant entire unequal divisions, which are veiny and somewhat hairy. The flowers are in terminal cymes. Each flower is about one-half or three-fourths inch in diameter and is composed of a five-cleft calyx, a five-angled wheel-shaped white or rose-colored corolla, which is plaited in the bud, five stamens closely pressed together in the center with rather long anthers and short filaments, and in the center enclosed by the stamens a pistil, which has a superior two-celled ovary,

a slender style, and a single stigma. The fruit is a small two-celled, many seeded berry one-half to one inch or more in diameter.

The nightshade family, because of its corolla of one piece, is related to such other families as the morning-glory, the mint, the snapdragon, and the sunflower, rather than to the buttercup, rose, and pink families, which have all the petals separate. The nightshade family is remarkable for the number of intensely poisonous plants that it contains, such as nightshade, belladonna, and henbane. It is even more remarkable that a family with so many poisonous members should produce such useful food plants as are the potato and the tomato.



POTATO WITH STRING PASSING OVER THE EYES, OR BUDS, TO SHOW THEIR ARRANGEMENT

The potato is really a perennial herb in which the tuber is the part that tides the plant over the unfavorable season. In this latitude it is not hardy, but is killed during the winter, a fact that obscures its real perennial nature. The tubers also serve as a mode of vegetative propagation. This method of increase has become so general in the case of the potato that, in some varieties at least, true seed production is rare.

The tuber is really a very much thickened portion of the stem on which the eyes are buds and the "eyebrows" are very much reduced leaves from the axils of which the buds spring. The tuber is borne at the end of a very slender portion of the stem, or rootstock, which also bears scale leaves. In the spring a tuber or more usually a portion of a tuber is planted. This is called the "seed," but is not to be confused with the true seed produced by the flower. From the lateral buds, or eyes, branches grow out, which rise through the ground into the air and later bear the leaves, the flowers, and the fruit. From the axils of the scale leaves on the portion of these shoots underground, other branches are sent out, each of which creeps

horizontally under the surface and gives rise at its tip to a potato, as before described. By examining a potato tuber it is not difficult to determine which is the apical end, both by the scar of the rootstock on which the tuber was borne, and by the position of the "eyebrow" scale leaves, which must be underneath the bud, or eye, to which they belong.

POTATO GROWING

DANIEL DEAN
A practical farmer

The potato was first found by white men in the high mountains of Peru. It thrives better in cool than in warm climates. In the South it is grown mostly in early spring or late fall in order to avoid the heat of summer. In the northwestern countries of Europe larger crops are raised than in this country because the climate is more favorable. In New York State the largest crops are grown when the seasons are cooler than usual. Extreme heat for a few days in summer greatly reduces the vitality of the plants and the size of the crop. Success in potato growing depends on attention to a number of details, neglect of any one of which may ruin the crop or at least make it unprofitable. Among these are the proper kind of soil, good seed of the right type, proper cultivation, prevention of damage by insects and diseases, and skill in marketing.

Potatoes need a large amount of water especially at the time the tubers are forming in the soil. About eighty pounds of water must be transpired from the leaves for each pound of tubers grown. The largest crops are usually obtained in New York State (except on Long Island) by planting after June 1, as usually the fall rains then come at about the right period in the growth of the crop. Too much rain in July and August may cause conditions favorable to the spread of the late blight disease. This sometimes kills the tops and rots the tubers in a few days. The terrible famine in Ireland in 1846 was caused by the late blight rotting the potatoes, which constituted the principal food of the people.

More potatoes are usually grown in New York than in any other State. The average money return per acre is higher for this crop than for any other commonly raised in New York; also, it responds more profitably to extra care than do most crops.

One great necessity with most New York soils is to obtain an abundance of humus. Soil is mostly made up of small particles of rock, but one of its most essential ingredients is humus, the organic remains of plants that have lived on it. This organic matter decays easily under cultivation and furnishes readily available food to the growing crop. Soils full of humus, such as newly cleared forest land and the western prairies

when first cultivated, are among the richest in the world. Potatoes, therefore, should be grown in connection with other crops that will supply plenty of humus. This is most easily obtained by means of heavy sods, especially of clover, by plowing under in the fall the straw of grain crops, and by the use of barnyard manure. If straw is allowed to rot in stacks, or meadows are mowed until they become thin, the conditions will not be so favorable for potatoes.

Humus not only supplies food for the plants, but is also very important as a means of holding water in the soil for their use. Water dissolves the

PHOTOGRAPH BY VERNE MORTON

CULTIVATING AND HOEING POTATOES PLANTED IN CHECKROWS

elements in the soil that are used by the plants, and holds those elements in solution. It is taken in by the plant roots and the water transpired from the leaves, leaving the plant-food behind. Humus in the soil greatly increases its productivity.

Since the potato is so easily affected by adverse conditions, it may be helped by the use of fertilizers. By this means it receives plant-food in easily available form, and the crop is kept in healthy condition when otherwise the plants might be stunted or even ruined. Consequently the best growers, particularly those of Aroostook County, Maine, and of Long Island, use 1000 to 2000 pounds of fertilizer per acre.

Fall plowing is often of great benefit in preparing the soil for potatoes, particularly if straw or other humus-making material is plowed under. This rots by spring and is in better shape for the use of the crop. On most sods a second plowing in spring, with a small amount of harrowing, is better than dependence on the harrow alone for spring fitting. Small applications of fertilizer may be applied in the row to give the plant a start. Large amounts of fertilizer are of more value if put evenly through the soil with a grain drill and thoroughly disked in. Then they are not so likely to injure the sprouts.

Potatoes should be planted as deep as the soil and the climate will permit, from two to six inches. In sandy soils it is best to plant deep and cultivate nearly level. If the soil is very retentive of moisture, or if much rain falls, as in Maine, it is best to plant shallow and ridge up the plants in cultivation.

The question of planting hills in checks, or of planting closer in drills, depends on the fertility of the soil and the number of weeds likely to grow. Some poor soils will not grow the tubers large enough if the hills are close together. In such cases hills are better than drills. Rich soils will grow larger crops if the plants are closer together in drills.

Large seed pieces increase the size of the crop over small ones. On most farms, 10 to 20 bushels of seed per acre planted in drills, or 8 to 10 bushels per acre in hills, will be the most profitable amount to use. If the seed is too small the plant may not get a good start; if too large, the increase in crop does not pay for the increased cost of seed. In seasons when seed is high, small pieces may be used and better care given the crop. When seed is cheap, large seed is often profitable.

Different varieties vary greatly in their adaptability to different soils. One of the most profitable practices in potato growing is testing for the best variety for a particular soil. Many new seedling varieties are being produced every year and are often sold at high prices. It must be remembered that the standard varieties are the ones that have proved best out of thousands. For trials it is best to get several of the varieties that grow well in the vicinity. They should be planted in adjoining rows, and the products measured and weighed carefully; the trial should be repeated two or more years in order to find the best yielders. So-called "blight-proof" varieties should be avoided, as they are usually late in maturing, and all yet tried are undesirable in some particulars.

Round or oblong and smooth white potatoes of good quality sell best; therefore late varieties for the main crop should have these qualities. Some of the best early varieties are red.

Every one knows how different hills vary in yield from almost nothing to several pounds. Sometimes this may be due to better soil or to larger

seed pieces; other hills may have been injured in some way; but often the high or the low yield is due to the natural ability of the hill to produce well. Separating these high-yielding hills from the rest pays better for the amount of work necessary than does anything else in potato growing. (See article *Improving Potatoes by Breeding*, page 158.)

Cultivation after planting has for its principal objects killing the weeds, saving the water in the soil by preventing evaporation, and making plant-food available. Cultivation between the rows should be deep at first, but shallow later so as to prevent injury to the roots of the plants. The weeder is a valuable tool to kill weeds in the row. It must be used before they get a start.

The original potato plant, when wild, blossomed before the tubers set. Now under cultivation both processes overlap. This usually comes in a period of hot weather and at a time when late blight is most active, and is the danger period in the life of the potato. If many roots are cut, the crop receives a shock from which it never fully recovers and it is prevented from making the yield that it might make. The whole profit on a crop may be lost by late tillage or hilling in dry weather.

Potatoes are subject to the attacks of several enemies (pages 118 and 124), the worst of which is the late blight and rot. This disease is carried through the winter in the tuber and after planting infects the vines. In damp, muggy weather the entire crop may be killed in a few days. The spores later fall from the leaves to the ground and, if the soil is very wet, may attack and rot the tubers. Dry weather checks the progress of the disease. Spraying with bordeaux mixture, made of sulfate of copper, lime, and water, is almost always profitable. The copper in the bordeaux kills the blight germs when they touch the leaf that is covered with it. The spray should be applied early in order to be on the leaf ahead of the blight. The time to spray is just before a rain if possible. The blight spreads only in wet weather. The growth of the plant constantly starts new leaves. The first rainstorm is the time these most need protection. It is impossible to predict what season blight will come. The gain from spraying in one year when blight occurs will pay for several years' spraying. Spraying with bordeaux mixture seems to have a tonic effect on the potato even when no blight is present. It also reduces the damage from several of the less important potato diseases.

Hand sprayers are used for small areas, barrel pumps and horse-power sprayers for the larger areas. In all cases the plants should be well covered at each spraying. The higher the pressure, the finer is the spray and the better are the results.

Seed potatoes should always be disinfected before planting. Rhizoctonia is a very serious disease present in practically all soils and infects

seed by little black masses of fungus which stick to the skin. These kill the sprouts when they start to grow and result in a poor stand of plants, many of which are late. Soak the seed tubers for one and one-half hours in a solution of four ounces of corrosive sublimate to thirty gallons of water and dry them before cutting. This solution is very poisonous, and it must be made fresh after being used three times. The corrosive sublimate treatment also kills potato scab, or formalin may be used, a pint to thirty gallons of water. Formalin does not kill rhizoctonia.

Care must be taken not to dig potatoes for winter storage until the tops have been dead ten days or more. Blight germs from the leaves may rot the tubers, especially in wet weather.

Potatoes in storage should be kept cool and dry, particularly if intended for seed. Loss from shrinkage, rot, and loss of vitality of the seed is least if the temperature can be kept just above freezing.

WHEN TO SELL POTATOES

K. C. Livermore
Professor of Farm Management

In the northern States potatoes can be stored for several months after they have been dug; and each year the farmer who raises potatoes to sell is confronted with the question, Shall I sell from the field or hold for a higher price. In answering this question wisely several things must be considered, for instance, what the price is likely to be several months after digging, and the cost of storage.

The price of potatoes fluctuates more widely than that of most general farm products. This is due primarily to variations in supply, and to the fact that potatoes cannot be stored readily from one year to the next. The quantity that farmers produce depends mostly on the favorableness of the season. In 1911 approximately 293,000,000 bushels of potatoes, or about 2.1 bushels for each person, were produced in the United States. That was a poor year for potatoes. In 1912, with practically the same area but with a much more favorable season, 421,000,000 bushels, or 3.6 bushels for each person, were produced.

The tendency is for people to use about the same quantity each year. During the last twenty years the amount used has averaged about 3.5 bushels per person. When there are not enough to supply this quantity, competition between the buyers increases the price. This causes some consumers to use less. When there are more potatoes than are ordinarily used, competition between the producers in selling lowers the price. This causes many people to use them more freely. In the winter of 1911 many farmers in New York State received $1 a bushel for their potatoes, but

the next winter when there were more potatoes than were needed, many were sold for less than 25 cents a bushel. The season of 1916 was very unfavorable for potatoes, and the total crop was only about three-quarters of the normal need. Instead of 3.5 bushels per person there were considerably less than 3 bushels. This shortage, together with shortages of other foods that might have been used as substitutes for potatoes, caused potato prices to go higher than at any time since the Civil War.

A study of the relation of potato prices to total production during the fifty-one years 1866 to 1916, inclusive, shows that every crop that was smaller than the normal brought relatively good prices, and that every crop that was larger than the normal brought relatively poor prices. For the years when the total crop was 75 per cent of the normal or less, the prices on December 1 averaged 94 cents per bushel. The average price was only 35 cents per bushel for the years when production was 25 per cent above normal or more. For the years when production was nearly normal the December 1 prices averaged 54 cents per bushel.

RELATION OF POTATO PRODUCTION IN THE UNITED STATES TO FALL PRICE, 1866 TO 1916 INCLUSIVE

Production as compared with the normal, given in percentage	Average farm price on December 1
75 or less	$.94
76 to 85	.65
86 to 95	.60
96 to 105	.54
106 to 115	.42
116 to 125	.43
Over 125	.35

The effect of size of crop is even greater on spring prices than on fall prices. There is a tendency to start marketing a crop at about the average price and then to raise or lower the price as is found advisable when the size of the crop becomes apparent. Usually, though not always, when production is below normal, the price increases. The increase is often 20 or 25 cents per bushel. When production is above normal, the price usually does not increase and sometimes decreases a little. For example, the 1911 crop of potatoes in the United States was only 83 per cent of normal. On November 1 farmers were receiving prices averaging 76 cents per bushel. Prices increased steadily until May 1, when they averaged $1.27. But in 1909 with a crop 17 per cent larger than normal, prices averaged 58 cents on November 1 and decreased to 38 cents the following May.

Thus, if it were known in the fall how many potatoes would be harvested, prices could be predicted with fair accuracy. The *Monthly Crop Report* published by the Bureau of Crop Estimates of the United States Department of Agriculture, Washington, D. C., gives this information,

A GOOD YIELD

and can be obtained without cost by schools or by individuals. It gives carefully made estimates of the acreage, condition, and yield of all the important crops, based on reports from thousands of farmers all over the country. It also describes the condition of crops in other countries from which shipments might be made to this country, thus affecting prices.

In October, 1914, it was estimated that the total yield of potatoes that season would be 384,000,000 bushels. Later the estimate was raised to 406,000,000 bushels. About 382,000,000 bushels would have provided the usual quantity per person. Because there were plenty of potatoes, prices started at 53 cents as an average for the United States in November, dropped to 49 cents in December, and continued at about 50 cents through the winter and spring.

The next year, 1915, in October the potato crop was estimated at only 368,000,000 bushels, and in November this estimate was reduced to 359,000,000, or 92 per cent of the normal need. This suggested good prices in the fall and increasing prices through the winter. Prices averaged a little over 60 cents in November and December and then increased to nearly $1 per bushel through the spring months.

In the fall of 1916 it was very easy to predict high potato prices. The October *Monthly Crop Report* estimated the crop at 301,000,000 bushels. As harvesting progressed, the estimate was reduced to 285,000,000 bushels. Allowing for increased population, 402,000,000 bushels were needed to provide the average allowance per person. Thus the crop was only 71 per cent of normal. Prices averaged $1.35 per bushel on November 1 and increased steadily, reaching $2.41 in April.

The production of potatoes in the United States has increased in the last seventeen years at the rate of approximately 10,000,000 bushels per year. This increased production is largely in response to the demands of an increased population. It is due partly to a greater use of potatoes because they are normally a relatively cheap food and partly to decreased imports, resulting from import duties, quarantines, or war conditions. It is probably safe, therefore, when predicting prices to assume that normal requirements will be about 412,000,000 bushels in 1917, 422,000,000 in 1918, 432,000,000 in 1919, and so on.

If in the fall it seems certain that the price will go up, the next question is, Will the advance be sufficient to pay for holding. The cost of storing is greater than many persons realize. It includes shrinkage of the potatoes, interest on the money that is tied up, cost of the extra work of handling the potatoes, use of the storage cellar or building, and risk of loss by fire. Most of these items do not necessitate a direct cash expenditure and for that reason are often overlooked, but they are, nevertheless, actual cost items.

Potatoes shrink in two ways; they lose in weight, and some of them rot and must be thrown out. Therefore the place in which they are stored and their condition in the fall have much to do with the amount of shrinkage. The storage place should be cool and moist, and the potatoes should be free from scab and blight diseases. When stored in cool cellars, the shrinkage is usually 5 to 10 per cent. Sometimes it has been as high as 20 per cent, and when rot is bad the shrinkage sometimes amounts to 50 per cent. But under good conditions a shrinkage of about 8 per cent should be expected. For every 100 bushels of potatoes stored in the fall, only 92 bushels can be counted on in the spring. If potatoes are worth 50 cents in the fall, the shrinkage will cost 4 cents per bushel.

A farmer who sells his potatoes in the fall can use the money to pay a note and thus save the interest that it bears. Or he can invest the money and receive interest for it. Or, better still, he can buy some good stock. Anyway he can use the money, but the farmer who stores his crop loses the use of it. Therefore another item of cost in holding potatoes is interest on the money tied up. The interest on 50-cent potatoes for 6 months at 5 per cent would be 1¼ cents per bushel.

One of the big items of cost is the extra work. This includes putting the potatoes into the storage pit or cellar, sorting them again, and taking them out of storage. The cost of this varies with conditions. Figures given by a number of growers who frequently hold the crop, average 4 cents per bushel.

The use of the storage cellar or building is another expense. This should be included because the money invested in such buildings should bear interest, and the buildings depreciate every year. About 10 per cent of the value of the buildings, or that part used for storage, is what it costs each year. This would amount to from a fraction of a cent to 2 cents per bushel — perhaps on an average, 1 cent per bushel.

Fire insurance would ordinarily cost less than 1 cent per bushel.

Assuming the potatoes to be worth 50 cents per bushel in the fall, these items may be calculated as follows:

	Average (cents)
Shrinkage	4.00
Interest	1.25
Extra labor	4.00
Use of buildings	1.00
Fire insurance	.12
Total	10.37

These figures agree with estimates given by farmers, a number of whom have said than an advance of 10 cents in price per bushel just about covers the cost of holding. Thus in order to make a profit on the holding, it would be necessary to receive more than this amount.

In a bulletin from the Maine Agricultural Experiment Station, the writer expresses the opinion that 50 cents for potatoes direct from the field is as good as 70 cents in the spring. A member of the Long Island Potato Exchange considers a 20-cent advance on 60-cent potatoes necessary to make holding profitable to the grower.

Several potato growers who have watched the markets for many years have said that in the long run it pays better to sell directly from the field than to hold. This is probably true, and if one were to choose between holding and selling in the fall as a regular practice, selling in the fall would be better. But it is also true that in some years it would pay the farmer to hold his crop. By learning what the total potato crop in the United States will be and the condition of the European crops, he can tell what the price is likely to be. If it seems that potatoes will advance more than enough to pay the cost of holding, it would be advisable to hold. If the advance is only a little greater than the cost, it would be better to sell in the fall.

POTATO TYPES

E. V. Hardenburg
Instructor in Farm Crops

Potato varieties originate in four ways, namely: (1) by seedlings grown from the seed of the potato seed ball; (2) by crossing existing varieties; (3) by the selection of widely varying types or inheritable variations, which occur occasionally in hills of tubers; and (4) by the selection and renaming of some desirable high-yielding strain of an existing variety. It is safe to say that most varieties have come about through seedlings and through the selection of high-yielding strains. Every year many new names are attached to old varieties by unscrupulous seedsmen to assist in selling seed stock as something new and promising. Also new names are occasionally given to seed potatoes by growers simply because the old name has been lost or has never been definitely known. Thus to-day, there are hundreds of so-called varieties of potatoes on the market, many of them identical so far as the eye can detect. This is not a desirable condition because many of these names give no idea of the type of potato to which they belong. The potato interests of the country would be much better off if only a few true varieties existed in each locality, and the good and bad qualities of these were more definitely recognized.

Most of the better varieties now grown commercially in this country have been studied carefully to compare them in habit of growth, tuber and vine characteristics, season of maturity, and regional adaptation. The Bureau of Plant Industry of the United States Department of Agriculture deserves much credit for most of this valuable work. In this way, many of the most popular varieties of to-day may be recognized as conforming to a certain definite type and as belonging to one of several groups of potatoes. Eleven such groups are now recognized: (1) Cobbler; (2) Triumph; (3) Early Michigan; (4) Rose; (5) Early Ohio; (6) Hebron; (7) Burbank; (8) Green Mountain; (9) Rural; (10) Pearl; and (11) Peachblow. Each of these groups is named from a popular variety in it, and each contains many varieties all of which conform approximately to a certain standard type. Some of these groups contain only early varieties, some contain only late varieties, while others contain both early and late varieties. For example, the Cobbler, the Triumph, the Early Michigan, and the Early Ohio groups contain only early varieties. The Rose, the Hebron, and the Peachblow groups contain early, medium, and late varieties, while the remaining groups contain medium and late varieties principally.

GROUP DESCRIPTIONS

The characteristics of the tuber are used principally in distinguishing between the groups. Thus the tubers of varieties within the respective

groups conform approximately to the following descriptions: (1) Cobbler, cubical shape, smooth white skin, few shallow to deep eyes, pink sprouts; (2) Triumph, cubical shape, smooth skin of red, pink, mosaic, or white color, medium to shallow eyes, pink sprouts; (3) Early Mich-

PLATE OF CARMAN NO. 3 POTATOES. RURAL TYPE

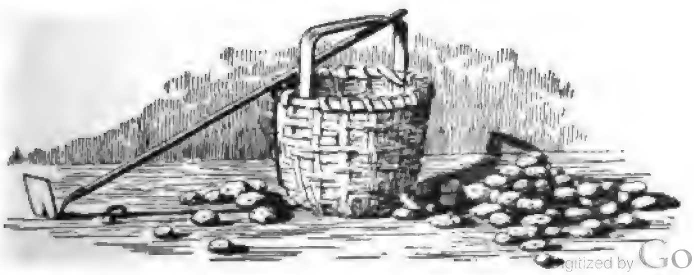
igan, elliptical flat to oblong flat shape, smooth white skin, many medium to deep eyes, pink sprouts; (4) Rose, elliptical flat, elliptical round, or oval flat shape, smooth pink skin, many shallow to deep eyes, pink sprouts; (5) Early Ohio, oval round shape, smooth white or pink skin, lenticels, or pores, prominent, medium number of shallow to deep eyes, pink sprouts; (6) Hebron, elliptical to oblong flattened shape, creamy white smooth skin, many deep eyes, pink sprouts; (7) Burbank, oblong round to oblong flattened shape, white smooth or russet netted skin, many shallow eyes, pink sprouts; (8) Green Mountain, oblong to oval flat shape, white skin rough to netted in texture, eyes medium in depth and number, white sprouts; (9) Rural, oval flat shape, white smooth skin, few shallow eyes, purple sprouts; (10) Pearl, oval round to oval flattened shape, smooth white or blue skin, eyes medium in depth and number, pink sprouts; (11) Peachblow, cubical or oblong rounded shape, smooth pink or white skin, many deep eyes, pink sprouts.

REGIONS OF GROWTH

The varieties within each group vary widely in their adaptation to growth in various sections of the United States. The Burbank is grown principally on the Pacific Coast and in the Rocky Mountain States, the Early Ohio in the Dakotas and adjacent States, the Triumph in the Southeastern and Gulf States, the Pearl and the Peachblow in Colorado, the Cobbler in the Northeastern States, and the Green Mountain and the Rural in the principal potato States along the Great Lakes. The Hebron, Early Michigan, and Rose groups are least grown of all and find favor in scattered sections of the Northeastern States principally. Most of the main crop of potatoes grown in New York State is of either the Rural or the Green Mountain type. Rural varieties in general set tubers somewhat later than Green Mountain varieties and are consequently apparently better able to withstand the drought conditions of midsummer which often prevail in western and central New York. Furthermore Rural varieties, on account of a somewhat thicker leaf epidermis than that of Green Mountain varieties, seem better able to withstand attacks of late blight. The favorable climate of northern New York, where blight seldom occurs, makes it possible for this section to grow the Green Mountain type successfully. Rural varieties are best adapted to central, southern, and western New York. Long Island produces varieties of the Green Mountain type almost entirely.

THE MARKET STANDARD

Most of the large potato markets of the East, especially New York City and Philadelphia, prefer a certain type of potato that is represented very well by most varieties of the Green Mountain or the Rural family. The standard market potato is now recognized as one that is six to eight ounces in weight, oblong flattened or oval flattened in shape, of smooth white skin, and having few and shallow eyes. A sample plate of this standard properly arranged for exhibit, except for lack of label, is shown in the variety Carman No. 3 in the illustration on the opposite page. This sample is typical of most varieties of the Rural type.



IMPROVING POTATOES BY BREEDING

C. H. Myers
Professor of Plant Breeding

Probably no plant lends itself more readily to improvement by breeding than does the potato. The term *breeding* includes the processes of hybridization, or crossing, and selection. The former is too complicated and technical for the use of the practical farmer, who may obtain results more directly by the simple process of selection. Hybridization may best be employed by experiment station workers, seedsmen, and others, for the production of new varieties. Indeed, this is probably the only method of producing really new varieties. Among the more than one thousand varieties of potatoes in the United States today, the process of selection may be used most readily as a means of improvement.

VARIATION IN YIELD OF TUBER UNITS GROWN SIDE BY SIDE

The two tubers from which these units came looked very much alike

PRINCIPLES UNDERLYING SELECTION

The success of selection in improving a particular crop depends on the amount of variation in that crop. No two plants or animals are exactly alike, even though they may develop under practically the same conditions. Any given variety of potatoes, therefore, is composed of a mixture of strains, each differing slightly from the other. Two hundred tubers may be chosen from a bin of potatoes of one variety. These tubers may appear very much alike in regard to uniformity, size, color, depth of eyes, and the like. Indeed, from external appearances one of these tubers seems to be just as good as another. But when the performance of these two hundred individual tubers is tested by the tuber-unit method it is apparent that they belong to different strains. For example, in such a test from a cooperative breeding plat the poorest unit yielded at the rate of 25 bushels per acre, while the highest unit yielded at the rate of 320 bushels per acre. From which unit would a grower prefer to save seed? Does the successful dairyman breed from the high- or the low-producing cows?

Selection does not produce anything new. It merely isolates what already exists. In this connection, selection is synonymous with isolation. After a desirable strain has been obtained in this manner, continued selection within this strain will not produce a change, unless there occurs one of those striking and comparatively infrequent variations that the plant breeder calls bud sports. That is, the different strains within a variety are permanent and are not changed by selection. They are separated from each other, and, since they differ, give the impression that the variety has been changed. It has been changed only in that certain undesirable strains have been eliminated and the average thereby raised. For example, in a certain variety that has been studied carefully in the Cornell experiments, six strains have been isolated. Their average yield over a period of five years is shown in the following table:

AVERAGE YIELD FOR FIVE YEARS OF SIX STRAINS ISOLATED FROM ONE VARIETY OF POTATOES

Strain	Bushels per acre
1	46
2	164
3	59
4	178
5	30
6	201
Average	113

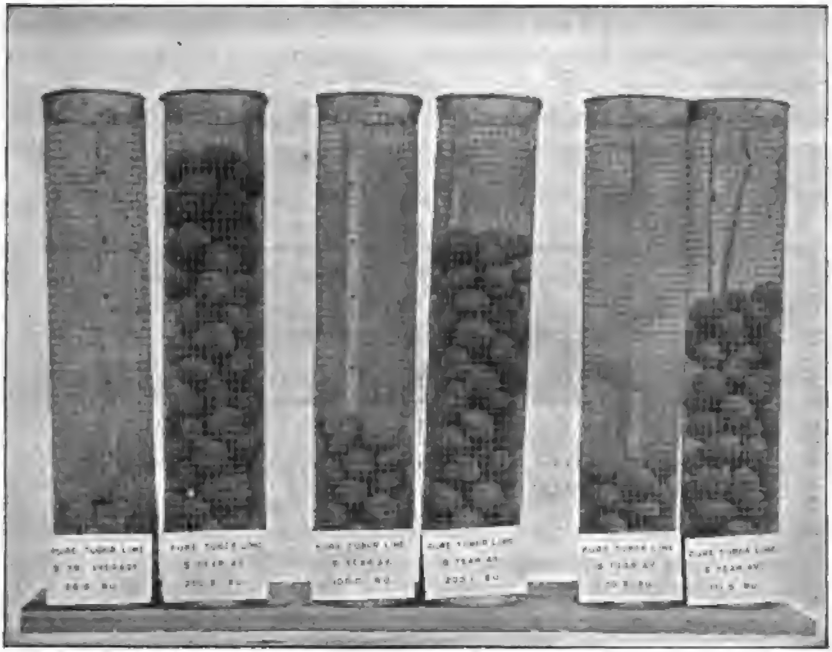
The average yield of the six strains is 113 bushels per acre. Considering only the three better strains the average yield is 181 bushels per acre. To carry the illustration further, if that particular variety had consisted of the six strains only, the average yield for five years would have been 113 bushels per acre. If by selection the variety had been made to contain only the three good strains, the average yield for the same period of time would have been 181 bushels per acre.

The action of selection as a means of isolating and eliminating inferior strains has been demonstrated by many experiments. Other experiments have been made that show the lack of effect of selection within the strain, at least as far as practical work is concerned.

METHODS OF SELECTION

There are two methods of selection that may be used by the practical grower and will give results. These are known as the tuber-unit method and the mass-hill method. A small plat conducted by the first method

might well find a place in the school garden or school home garden as a demonstration of the variability within a variety of potatoes and of the method for improving the variety. The method given here in detail is recommended for the use of the potato grower who has the time and the inclination to do careful work. The only modification of this for the use of the school garden should be in the number of tubers with which the experiment is begun. However it is important to start with a large number,



THE AMOUNT OF TUBERS IN EACH CYLINDER REPRESENTS THE FIVE-YEAR AVERAGE YIELD OF SIX DIFFERENT STRAINS OF POTATOES

These strains were isolated by the tuber-unit method of selection

and, if any practical results are to be obtained, not less than 100 tubers should be chosen, and as many more as space and time will permit.

Tuber-unit method

The following is an outline of the tuber-unit method:

First year.— Select 500 tubers of ideal shape and size for planting, giving each a pedigree number from 1 to 500. This first selection is very important; therefore it is best to deal with a large number of individuals the first year. Divide each of these tubers into four pieces of approximately equal size, cutting from end to end so that each seed piece contains

a part of the stem and seed ends. Plant each piece in a hill by itself, having each four-hill unit (the four hills from one tuber) marked by a number to correspond to the number of the original tuber.

During the growing season, great variation may be observed between the different units, in regard to habit of growth, number of stems per hill, color of foliage, time of blossoming, resistance to disease, and the like. It is desirable to make a note of any striking variations of this kind. At harvest time these notes are useful in making selections.

Treat these breeding hills the same as the general crop. At harvest time dig the four hills that comprise a tuber-unit by themselves, throwing them together in one pile. Then go through the breeding patch and discard all tuber-units that are obviously poor in shape, size or color of tubers, or total yield. Next select the 50 tuber-units having the highest yield. This can be done by using an ordinary set of grocer's scales. Retain 10 good-sized tubers from each of the 50 selected tuber-units, and discard the rest. These may be kept over winter in 12-pound paper bags. Record on each bag the pedigree number of the tuber-unit and its weight.

There will be 50 bags containing 10 tubers each, to be stored over winter. The tubers in each bag constitute a strain. That is, they all came from a single parental tuber.

Second year.— Each of the 500 tubers that have been retained for the second year's work should be cut into four pieces as before and each piece planted separately. Each of the 500 tubers should be given a new pedigree number so that the progeny of each can be identified to compare with the yield of its mother parent. For example, suppose that tuber no. 25 of the first year gave a very high yield. The actual yield of no. 25 would, of course, be found at the end of the first year. This yield would be recorded on the bag containing the 10 tubers from tuber no. 25. At the beginning of the second year give each of the tubers in bag no. 25 a new pedigree number thus: 25–1, 25–2, 25–3, and so on to 25–10.

At the end of the second year proceed as before. Throw together in one pile the four hills forming each tuber-unit. Discard all poor ones, and select, as before, the 50 tuber-units giving the highest yield. In making this selection the second year, all the hills of a given strain, for example, from no. 25, should be considered. Retain 10 tubers of each, and record on the bags the pedigree numbers and weights as at the end of the first year. Most of the tubers from the breeding patch of the second year will be select tubers and will probably represent not more than ten strains. After the 500 tubers for the third year's planting have been selected, retain all remaining tubers for the general field crop of the third year.

Third year.— Proceed exactly as at the beginning of the second year. It will be necessary to give each tuber a new pedigree which may be done as follows: Suppose that tuber no. 25–8 of the second year should give a high yield and its progeny should be retained for planting the third

HARVESTING A TUBER-UNIT BREEDING PLOT ON A SCHOOL GARDEN IN WESTCHESTER COUNTY

year. The 10 tubers in the bag marked 25–8 should now be numbered according to the system suggested, thus 25–8–1, 25–8–2, 25–8–3, and so on. This system of numbering will allow the breeder to know the performance in pounds per hill of the ancestors of each selected hill. This is just as desirable as to know the pedigree of a dairy cow.

At the end of the third year, the selections made will represent only a few superior strains. The others will have been eliminated. All the good tubers from these selected strains may then be thrown together as pedigreed seed and should be planted in a separate portion of the field so that they may be harvested together and used as seed for the general crop.

Mass-hill method

The method of mass-hill selection is much simpler than the tuber-unit method. In the long run it will result in the isolation of superior strains, but it will require a longer period of time. Only a limited number of potato growers will use the tuber-unit method, but every one who saves his own seed should at least practice mass-hill selection.

The method of procedure is to dig a large number of hills by hand, perhaps two thousand or more, each year. The tubers from the best of these hills are selected by inspection and thrown together to be planted in an increase seed plat, which can be located in a section of the regular field. This seed plat will furnish a supply of seed potatoes to be used in

the regular field, and it should have newly selected hills brought into it each year from the general field or from other sources, as may be available.

RUNNING OUT OF SEED TUBERS

A great deal has been written about the running out of seed tubers, and some growers advocate a change of seed tubers every year or so in order to maintain the yield. The facts are not to be denied. Varieties of potatoes have degenerated, or run out. It is not likely that this is due to the fact that potatoes are propagated by cuttings rather than by seed, as is popularly supposed. It is probable that there are several contributory causes.

AN ORANGE COUNTY FARMER'S POTATO BREEDING PLAT

Among these may be mentioned unfavorable climatic conditions. It is well known that hot, dry weather has a deteriorating effect on potatoes. There are certain regions where for this reason it may be advisable to use imported rather than home-grown seed.

Potatoes may also degenerate on account of attacks by certain diseases that affect the yield and that are carried over by the tubers from one generation to another.

Still another cause may be attributed to lack of care in selection of seed tubers. A large number of growers make no selection whatever and sometimes have even planted culls. This procedure would tend to a condition of degeneracy.

The method of hill selection eliminates all these causes except that of environmental conditions, which for New York State applies only to restricted localities. It may be stated with assurance that in all regions of the State where conditions are favorable to potato growing, there will be no running out of seed tubers if some form of hill selection is practiced.

QUALITY IN POTATOES

E. V. Hardenburg
Instructor in Farm Crops

Very few potatoes are actually bought and sold on the basis of recognized cooking quality. The price paid is varied according to appearance as influenced by uniformity of size and shape, color of skin, depth of eyes, and freedom from diseases and blemishes. Fortunately, good external appearance of potato tubers and good quality go hand in hand. In this, potatoes differ from apples. Most persons are familiar with the fine appearance of a highly colored Ben Davis apple and with its coarse texture and flat flavor.

Potatoes that develop in heavy wet soil and that are subject to the attack of various potato diseases are very likely to be knobby and irregular shaped. The skin or perhaps even the outer layer of flesh is also likely to be rough, uneven, or decayed. Potatoes of this type are often watery at the center, and are soggy when cooked. In general, it may be said that any factor of soil, climate, or cultural practice that tends to promote uniform development and complete maturity of the plant, will also increase the cooking quality of the tuber.

STANDARDS OF QUALITY

In France, good quality in potatoes refers to the capacity of the tubers to retain their original form and to remain waxy after baking or boiling. Most of us are familiar with the quality and appearance of French fried potatoes. The standard of quality in America is quite the opposite. The American public, as a rule, prefers mealiness in cooked potatoes. Mealiness is associated with starchiness or high starch content. Most of us like to see boiled or baked potatoes fall apart easily when ready to serve.

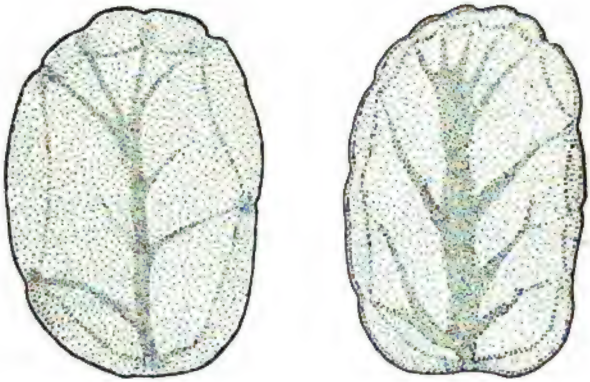
About 20 per cent of a normal tuber has direct food value, the remainder being principally water. The average analysis of a fresh potato is 78.3 per cent water, 18 per cent starch, 2.2 per cent protein, 1 per cent ash, .4 per cent crude fiber, and .1 per cent fat. The proportion of starch and water may be higher or lower depending on whether the tuber is of high or low quality.

INDICATIONS OF QUALITY

Starch grains are deposited in the cells of potato tubers as the season of maturity advances. Anything that arrests development of the plant also lowers the quality of the harvested crop. Early varieties when harvested before the tops die in order to take advantage of early market prices, are often of poor cooking quality because of lack of maturity.

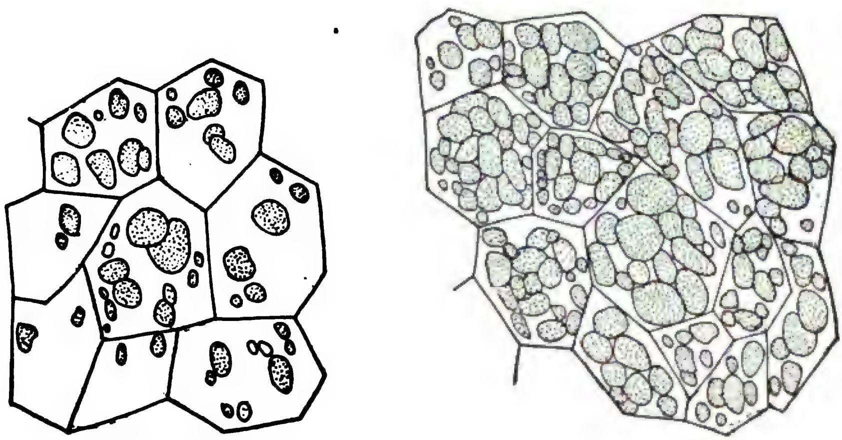
Maturity and its attendant high starch content are often indicated by a netted character of the skin. Lack of maturity, on the other hand, is indicated by a tendency of the skin to curl. Thus early potatoes or late potatoes dug when immature may be observed on the early market in this condition.

Mealy and soggy potatoes differ in their anatomical make-up principally in the number of starch grains in the cells. The lower illustration shows this difference in cells taken from the outer medullary areas of such types. When cooked, these starch grains expand and fill the cells; and in good quality potatoes there is enough starch to cause the cell walls to burst. In tubers of low quality, there is not enough starch to burst the cells, and the result is a soggy or waxy potato, or one that holds its original shape when cooked. High quality potatoes have uniformly white flesh



Good quality Poor quality

CROSS SECTIONS OF POTATOES SHOWING HOW QUALITY IS INDICATED BY APPEARANCE; REDUCED IN SIZE



Cells from a soggy potato Cells from a mealy potato

CELLS FROM THE OUTER MEDULLARY AREAS OF POTATO TUBERS OF DIFFERENT QUALITY SHOWING DISPOSITION OF THE STARCH GRAINS; MUCH ENLARGED

as observed in cross section. Such potatoes appear crisp and cut with a snap, indicating that the cells are well filled with starch. Poor quality potatoes seem more rubbery or elastic when cut. In cross section, such tubers may exhibit a dark watery section at the center, which is lower in starch content than the outer area. The upper illustration on page 165 shows the principal differences in appearance of the cross section of a good and of a poor quality potato.

If two or three varieties of potatoes can be obtained, section them and examine the sections for some of these differences. Hold a thin section of each variety up to the light. Note the areas of greatest starch content. Iodine gives a blue reaction when applied to starch. Place a few drops of dilute iodine on these thin sections, and the relative amount of starch in each area may be determined by the depth of blue color resulting.

ONE CLOVER, ONE GRAIN, AND ONE GRASS, FOR RECOGNITION IN 1917-1918

E. G. Montgomery
Professor of Farm Crops

WHITE CLOVER

White clover is found growing wild throughout all parts of New York State. There is hardly an old pasture that does not contain at least some plants of white clover. It seems to be naturally adapted to grow with Kentucky bluegrass, as they both do well on the same kind of soil and will grow together without either one crowding out the other. White clover is very commonly sown in lawns and, to some extent, for pasture. However, in most pasture lands it has never been sown, but has come in as a wild plant. It is very interesting to know that white clover can produce seed under even the closest pasturing or on a lawn that is cut every week with a lawn mower. Under these conditions seed heads are produced on very short stems right next to the ground. Another interesting character of the seed is its ability to lie in the ground for many years without sprouting. Some of the seeds will grow right away, but others will remain there for two or three years, or even as long as ten years, before they

WHITE CLOVER, SHOWING HABIT OF SPREADING
Reduced in size

grow. By this means, whenever white clover once becomes abundant in a field, it will usually be found there coming up in a voluntary way whenever there is an opportunity.

White clover also spreads by means of underground roots or, more commonly, by the stems spreading along the ground and taking root at the joints. Plenty of examples of this can be found in an old lawn or a pasture field. In an old pasture there will be many spots of white clover that are almost circular in shape. Some of these spots will be only about one foot across, and others may be five or ten feet across. These areas have probably developed from a single plant that has spread equally in all directions.

BED OF WHITE CLOVER

Other clovers also tend to grow wild in all parts of the State, and it would be well to learn how to distinguish between white clover, alsike clover, and red clover, even without the flowers. Find plants that are in blossom, and then compare the leaves and manner of growth of the different kinds very carefully until the distinctive characters of each are recognized.

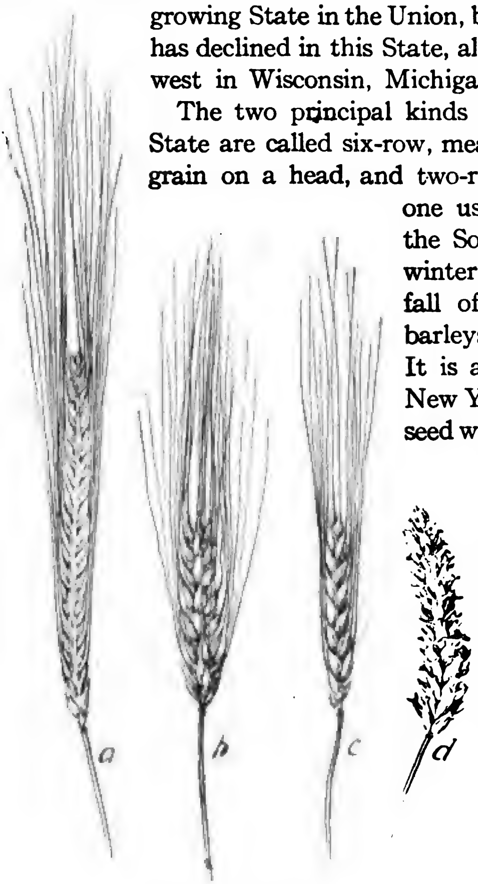
As a field exercise, make a study of the lawns, roadsides, and pastures of the district to see whether white clover can be found growing in all these places. Also take up vigorous plants where they are growing in soft ground, as at the edge of a cultivated field, and note how the stems spread along the ground and take root at the joints. It would be well to make a sketch of this. In midsummer, observe how white clover produces seed heads even in pastures where the cattle keep the grass eaten down closely and in lawns where the grass is cut very short. Do any other clovers in the neighborhood produce seeds under these conditions?

BARLEY

Barley is the fourth cereal in importance in the United States, being exceeded in production by corn, wheat, and oats. It is not cultivated

throughout so wide an area as other grains, being more adapted to northern climates. For example, in the great Corn Belt of the United States, where so much corn, wheat, and oats are grown, there is very little barley. It is grown mostly in the northern tier of States and on the Pacific Coast. New York during the Civil War was the most important barley-growing State in the Union, but in recent years barley culture has declined in this State, although it has developed farther west in Wisconsin, Michigan, and Minnesota.

The two principal kinds of barley grown in New York State are called six-row, meaning that there are six rows of grain on a head, and two-row. The six-row barley is the one usually grown in this State. In the South, there is a sort known as winter barley, which is sown in the fall of the year, but in New York barleys are always sown in the spring. It is a very common practice among New York State farmers to mix barley seed with oats, using about equal parts of each. The two are threshed together and used for stock feed. This mixture is grown not only because it is believed that the total yield of grain is larger, but also because barley, having a stiff straw, probably prevents the oat straw from falling down at harvest time, as it sometimes does when there is a great deal of rain.



TYPES OF BARLEY

a, two-row, bearded, hulled; b, six-row, bearded, hulled; c, four-row, bearded, hulled; d, six-row, beardless, hull-less. All reduced in size

About three-fourths of the barley raised in the United States is used for stock feed, but about one-fourth is now used for malting. Barley is the principal grain used for the latter purpose.

As a field exercise it would be well to get samples of all the kinds of barley grown in the district. See how many different varieties can be found. Also find out how many acres of pure barley are grown in the district and how many acres mixed with oats. Ask farmers why they mix oats and barley. If barley cannot be found in the school district, it

would be well to inquire whether it was ever grown there and why the farmers stopped growing it. A few samples of barley might be obtained from a seedsman and grown in a garden in order to become familiar with the different kinds.

BARLEY SMUTS

Editor's note.— Professor M. F. Barrus of the Department of Plant Pathology has contributed the following paragraphs as of interest in the study of barley.

There are two smuts occurring on barley: the loose smut, which affects the plant so that the entire head is transformed to a black smutty mass of spores and later, after these spores are disseminated, leaves nothing of the head but the flower stalk; and the hidden, or covered, smut, which transforms the entire seed and seed coat to a smutty mass of spores enclosed by the thin membranaceous glumes, or chaff. This chaff holds the smut spores so that they are not easily scattered until the grain is harvested and threshed. Both kinds of smut may be found in the same barley field.

PLOT OF BARLEY

The loose smut cannot be destroyed by seed treatment with formaldehyde. The hot-water treatment is effective, but it is so troublesome to make that it is not generally recommended unless the smut is severe and clean heads cannot otherwise be obtained. The covered smut of barley can be controlled by the formaldehyde treatment used for the control of oat smut. The cleaned barley seed should be thoroughly wet by sprinkling it with formaldehyde solution, using 1 pint of 40-per-cent solution to 40 gallons of water. The grain should then be thrown into a pile and left covered with grain sacks and blankets or canvas for five hours or more, after which it may be spread out to dry. It is important to have the grain thoroughly dried if it is not to be sown at once, and in such cases it is safer to leave it spread out to prevent it from heating. When hard smutty kernels are present in the grain to be treated, more satisfactory results can be obtained by immersing the

grain in the formaldehyde solution and skimming off the smutty kernels, which will float to the surface.

REDTOP

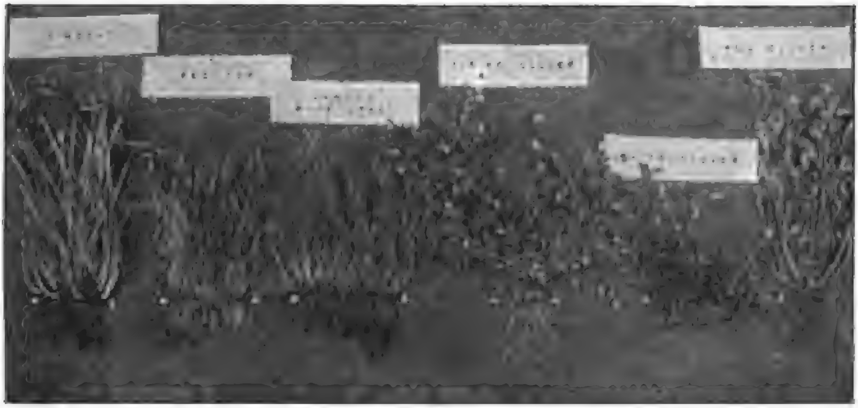
The name redtop is used very commonly for this grass due to the fact that when in seed the head has a slightly reddish appearance. It is known in New England as herd's grass, and sometimes this name is also applied in New York State. The name bent grass is sometimes used, but there is a slight difference between redtop and the real bent grass. They are similar in almost all respects except that the bent grass is much smaller and finer leaved. Redtop is usually sown for hay or pasture purposes, while bent grass is usually sown for lawns although it also makes excellent sheep pasture.

HEAD OF REDTOP
Reduced in size

Redtop differs from timothy in one very important respect. While timothy spreads very little from the roots, redtop produces a large number of underground stems that spread out in all directions so that a single plant in the course of a few years may cover a large area of ground. In this way it forms a very close, thick sod, in the same way that Kentucky bluegrass does. This makes it especially good for lawn or pasture purposes. Redtop will also grow on much poorer soil than timothy, especially on soil that is sour or lacks lime. In some parts of the State, where timothy will not grow usually, such as worn hill land, the only kind of grass that can be cultivated is redtop. Wherever farmers can grow timothy they prefer it, both for hay and for pasture, as timothy usually produces more per acre and the animals like the hay better; but on land where timothy fails to do well, redtop is generally cultivated instead. In New York redtop is very commonly grown throughout the whole southern half of the State and more or less in other sections. Redtop, like bluegrass, is found wild in all parts of the State. Even where it is never sown in pastures it is very likely to come in, and on some kinds of soil it will in time be the only grass found growing there though it was never sown. It spreads, of course, by means of seed growing in waste places, or the seeds are scattered in the fields by various means.

As a field exercise the children should learn how to identify redtop not only when it is in seed, but also when the small plants are growing

in pastures or meadows. At least they should be able to distinguish redtop from timothy, the plant with which it will most commonly be found growing. Make an inquiry among the farmers of the neighborhood and find out how many sow redtop as a mixture with timothy. Do the



MOUNT SHOWING TYPICAL SPECIMENS AND RELATIVE SIZES OF TIMOTHY, REDTOP, CANADA BLUEGRASS, ALSIKE CLOVER, WHITE CLOVER, AND RED CLOVER, READING FROM LEFT TO RIGHT

farmers like redtop for hay as well as timothy? Do they like it for pasture purposes? Is redtop found growing wild along the roadsides or in old meadows? Is it very common in all the old pastures? Dig up a large old plant of redtop and also a large plant of timothy and compare the root systems. Note especially the strong underground stems by means of which redtop spreads through the soil. It would be well to collect for the schoolroom all the common cultivated grasses found in the neighborhood.

PLANTS TO BE RECOGNIZED IN 1917-1918

Editor's note.— The material on the two vegetables, squash and turnip, has been prepared by Paul Work, Acting Professor of Vegetable Gardening. The other articles are the work of K. M. Wiegand, Professor of Botany.

WILLOW

The various willows are well-known trees and shrubs growing by stream banks and roadsides, or often planted about ponds and streams to keep the banks in place. Low grounds and marshes often present dense growths of the more shrubby forms of willows.

Willows may not always be easy to recognize by the beginner. In general they are woody plants that flower before or with the leaves. In the spring the flowers are of two sorts: the male, or staminate, and the female, or pistillate. These two sorts are borne on different plants, and thus

the willow is said to be diœcious, which means "in two households." Both types of flowers are borne in slender spikes, called catkins, springing from lateral buds along the sides of the previous year's twigs. The flowers themselves are extremely minute and reduced in structure. The staminate flowers consist of from two to five stamens, and the pistillate flowers, of a single pistil, with no calyx nor corolla. A little honey gland is located on the upper side of the flower. One flower is borne behind each of the tiny scales scattered abundantly throughout the catkin. The pollen is carried by the wind or by insects. The fruit when ripe is a very small capsule, the parts of which on splitting expose the small seeds, each having a tuft of silky hairs. The hairy tuft is caught by the wind, and thus the seeds are distributed. Willow leaves are alternate, usually narrow in shape, pinnately veined, and the margin is usually toothed.

WHITE WILLOW

Willows are of many kinds. In central New York there are from twelve to fifteen species; some are shrubs while others are treelike. The *pussy willow* is a shrubby form growing in damp thickets. The pussies are the unexpanded flower buds after the bud scales have fallen off. The silky hairs are borne on the scales of the catkin, before mentioned. Thus a willow is not really in flower when the pussies are present. The *white willow* is a large tree often planted on stream and pond banks. The twigs are yellow. The *black willow* is a small, rather scrawny tree in

low ground, which, because it starts so late in the spring, often presents a dead appearance after other trees have leaved out. The branchlets of this tree are very brittle at the base, and a vigorous shaking will often produce a shower of branchlets, which, floating down stream, will take root on mud bars and thus vegetatively reproduce the plant. The *basket willow* is grown for the long slender branchlets, which are woven into baskets and wicker furniture.

The willows belong to the willow family, which also contains the poplars. Other catkin-bearing plants of related families are: walnut, hickory, chestnut, oak, beech, birch, and the like.

CHERRY

The cherry belongs to the rose family and is a close relative of the peach, the plum, the apricot, and the almond. It is a more distant relative of the apple, the pear, the strawberry, the raspberry, and others — all of which belong to the same family. The cherry and its close allies are recognized by the peculiar fruit called a drupe, which is fleshy with a single stone. This stone is not the seed, but a hardened part of the wall of the fruit in which the seed is enclosed. The wall of the ovary in these plants ripens into two parts, a fleshy outer part and a stony inner part. All cherries are trees or shrubs, mostly with showy white flowers borne in either umbel-like clusters or racemes, or rarely solitary. They consist of a cup-shaped termination of the pedicel on the edge of which are borne, five sepals, five petals, and numerous stamens. In the bottom of the cup and free from it inside, is the pistil, which consists of a one-celled, one-seeded ovary, a style, and a stigma. By this peculiar structure of the pistil part of the flower, one can easily recognize the difference between a cherry blossom and that of an apple or a pear. The bark of the cherry tree is usually rough and often mucilaginous, giving rise to globules of cherry gum on the surface, In many species, the bark is bitter and of peculiar flavor due in part to hydrocyanic acid, which is also produced in the seed. Hydrocyanic acid is a poison, but is present in such small quantity as to be ordinarily innocuous. The fruit when ripe varies from the size of a buckshot to that of a large marble, and the color is red, yellow, black, or purplish black.

The *wild black cherry* is a large and widely spread forest tree, and is the source of cherry timber. It was originally abundant, but most of the large trees have been lumbered. The small flowers are borne in drooping racemes. The leaves are rather narrowly elliptical, thick, and pointed, with fine blunt teeth. The cherry bark obtained from this tree was formerly used as a family medicine, the bitter properties being considered

a tonic. The fruit is scarcely edible, but is important as a food for wild birds.

The *chokecherry* is a small tree or usually simply a shrub. The flowers are borne in the same manner as those of the black cherry and resemble those of that plant. The leaves are much thinner and broader with sharp spreading teeth. The flavor of the bark and the fruit differs from that of the black cherry, being somewhat skunklike. The fruit is astringent and scarcely edible. Chokecherries are found in great abundance along roadsides, river banks, and almost anywhere in northern North America.

Pin cherry, or *pigeon cherry*, is a small tree with redder bark than the chokecherry. The flowers are small and are borne in umbel-like clusters, or sometimes in corymbose clusters. The leaves are narrowly elliptical, with scattered, short, irregular incurved and blunt teeth. The fruit is about the size of a buckshot, light red, and very sour. The pin cherry is common on burned or cleared areas, where it seems to spring up after forest fires.

The *sand cherry* is a dwarf species, about two to three feet high, growing in sandy or more or less sterile soil in various parts of the country. The leaves are inversely lance-shaped with a few broad teeth toward the apex. The flowers are borne in umbels, and the dark purple fruit is nearly two-thirds the size of the garden cherry.

The dark purple form of the *cultivated cherry*, or *garden cherry*, frequently escapes from cultivation and may be found by the roadside and along fence rows in many parts of New York State. The red garden cherry very rarely is found escaped.

The cultivated cherry is discussed in the section on tree study (page 207).

DAISY

The common white daisy is found almost everywhere in eastern North America converting the hillsides and fields into vast showy stretches of pure white during the month of June. The plant though so abundant is not a native of North America, but has come from the Old World.

The daisy is a plant about one or two feet high with many single stalks springing from a perennial root. It bears alternate oblong leaves of small size, which are more or less coarsely toothed or lobed. The stems are terminated by solitary "flowers," which are rather large for the size of the plant, being one or two inches in diameter. These so-called flowers are not really such, but are aggregations of tiny individual flowers. Such a compound structure is more properly called a head. The head is surrounded by a series of closely pressed protective bracts. Around the margin is a row of showy white rays, each representing the corolla of an individual ray flower. The center is made up of very numerous

and very tiny tubular flowers, or florets, as they are called. Later in the season each of the flowers in the head produces a fruit, which is seedlike in appearance. The stamens and the pistil of this plant are found together in each of the tubular florets, as is to be expected when these are correctly thought of as the real flowers of the plant. There are five stamens and one pistil in each flower. The ray flowers have a pistil only.

The daisy belongs to the so-called composite, or sunflower, family, because the flowers are borne in heads. Relatives of the daisy are sunflower, aster, black-eyed susan, goldenrod, marigold, dandelion, thistle, and others. It is interesting to note that the daisy belongs to the same genus as does the garden chrysanthemum.

MARSH MARIGOLD
About one-fourth natural size

MARSH MARIGOLD

The marsh marigold, often called cowslip, is a common and well-known plant in low marshy meadows in early spring. Its leaves when young are used for greens, and the showy flowers make attractive bouquets.

The marsh marigold may be recognized by its large round or kidney-shaped leaves of glossy texture, finely toothed margin, and heart-shaped base. The plants are about nine to twelve inches high, more or less tufted, and terminated by numerous rather showy yellow flowers nearly one inch in diameter. These flowers have no corolla, the showy portion being composed of five to seven large yellow sepals. The stamens are very numerous, and the pistils are several, all distinct. The floral parts are all inserted on the receptacle distinct from each other. The fruit is a follicle splitting along the inner side and thus allowing the seeds to escape.

The marsh marigold belongs to the buttercup family as is indicated by the separate parts all inserted independently underneath the ovary. Some of its relatives are larkspur, columbine, peony, buttercup, anemone, clematis, monkshood, and Christmas rose.

ANEMONE

Every one accustomed to the woods has undoubtedly become familiar with one or more of the various kinds of anemones. There are several of these interesting plants, for instance, the Virginian anemone, the Canadian anemone, and the windflower, besides the Japanese anemone so frequently grown in the garden for its fall bloom.

The anemones are perennial herbs having rather short rootstocks and often with fleshy roots. The leaves are borne at the crown of the root, and also in a few whorls on the stems and branches. They are palmately divided, or compound, with the divisions coarsely toothed and cut. Those from the roots are borne on long stalks, while those on the stems are on short stalks or sometimes with the stalks entirely wanting. The flowers are borne singly or scattered along the top, often terminating long erect branches. They consist of a colored calyx of from five to eight separate sepals, a large number of stamens, and also a large number of separate pistils. The corolla is wanting. All the parts are separate and inserted on the end of the flower stem underneath the pistils. On fruiting, each pistil becomes a seedlike dry fruit in which the solitary seed is enclosed. The fruits do not open to allow the seed to escape.

VIRGINIAN, OR TALL, ANEMONE
About one-third natural size

The *Virginian anemone* is tall with several whorls of leaves, each leaf of which is stalked. The fruit is very woolly. This species is found on dry wooded banks.

The *Canadian anemone* is similar to the Virginian, but the stem leaves have no stalks and the fruits are smooth. The Canadian anemone is also found on dry wooded banks.

The *wood anemone*, or *windflower*, is quite different, being very small and having long creeping rootstocks. The flowers are mostly solitary, and the fruit is smooth. These little plants of about six inches in height are characteristic of the woods in the spring.

Other species of anemone flower much later in the spring, while the *Japanese anemone* of the garden is probably the latest garden plant to flower in the autumn.

Anemones belong to the buttercup family, and among their near relatives are buttercup, clematis, larkspur, monkshood, goldenseal, meadow rue, and Christmas rose.

TRILLIUM

The woodlands in early spring in many parts of the country are converted into wonderful flower gardens by the abundance of trillium, several species of which are among the most characteristic woodland plants. The flowers are so large as to render them very conspicuous.

Trilliums are perennial herbaceous plants growing from short, stout rootstocks. The leaves are borne in a whorl of three at the top of the naked stem and are for the most part broad and rhomboidal with pointed apex, entire margin, and narrow rounded base. The veins are netted, and the surface smooth. The flowers are large and solitary from the apex of the stem above the whorl of leaves. These flowers consist of three green sepals, three green or colored petals, six stamens, and a three-celled ovary with three styles. The other parts of the flowers are all inserted underneath the ovary. The fruit is a large red or yellow berry produced in summer.

WHITE, OR SHOWY, TRILLIUM

About one-third natural size

The *white*, or *showy*, *trillium* is perhaps the most conspicuous of the various species, and the most abundant, especially in the rich woods of the central East. The petals are very large and inversely egg-shaped.

The *red trillium*, also frequent in the woods of the Eastern States, has dull brick-red petals, more pointed than those of the white species. It is also interesting because of the peculiar odor of the flower which renders it unsuitable for household decoration.

The *painted trillium*, with flowers somewhat similar in shape to the last mentioned, has white petals striped with red at the base, and the leaves have short stalks. This species is common in the woods of the northeastern part of the country. There are also several other species common in various other parts of the United States.

The trillium belongs to the lily family, and among its relatives are such common and well-known plants as lily, onion, tulip, hyacinth, and asparagus.

PARTRIDGE BERRY

On dry banks in open woodlands, especially near the shade of evergreens, one will often find patches of a very graceful, creeping evergreen plant with small round leaves and scattered red berries somewhat smaller than a pea. This is the partridge berry, a frequent plant throughout northeastern North America. In northeastern Canada, however, another plant is commonly called partridge berry, a plant that does not grow in New York State except on the highest mountains. Partridge berries frequently have a slight wintergreen flavor, and are often picked and eaten by children. The berries are, however, too few and too dry to be of much importance. The green sprigs with berries are often collected for decorative purposes, being placed in transparent glass bowls with dampened moss, where they will keep green through the winter.

PARTRIDGE BERRY
About one-half natural size

For the purpose of recognition, the plant should be described a little more in detail. The partridge berry is a perennial. The creeping stems bear the leaves in opposite arrangement. The leaves are about one-half an inch in diameter, smooth, and leathery, and are borne on short stalks. The flowers are borne in pairs, each pair being nearly sessile. The ovaries are united into one. The calyx is very small and consists of four teeth at the summit of the ovary. The corolla is about one-half inch long or somewhat less, and is tubular below with an abruptly spreading four-lobed border. These flowers are white tinged with pink, and the lobes on the upper side are covered with a dense woolly growth. The whole effect is dainty and beautiful, and is heightened by the delicate fragrance of the flowers. In late summer the scarlet red berries are produced, which remain over winter. Each berry contains about eight small seeds. No one who has once become acquainted with this beautiful little woods plant will ever have difficulty in recognizing it.

Partridge berry is a source of great trouble to the herbarium maker, as it shows a most unfortunate tendency to blacken in drying. The collector finds that after a few days his entire specimen with its dainty

flowers has turned black in color. In this respect it is similar to the Indian pipe. Rapidity in drying helps to maintain the color, but it is not possible to keep it normal.

The partridge berry belongs to the madder family, which is found for the most part in tropical regions only. A few species however occur in New York State. Among them are bedstraw, bluets, and buttonbush. Among the tropical relatives of the partridge berry are the coffee and the chinchona, from the latter of which quinine is obtained.

BLACK MEDIC

The black medic is commonly mistaken for clover as it has many general characteristics of this group. It is found in the late spring and through the summer in lawns, along roadsides, or in waste places, where it creeps extensively over the soil. It is so common and widely distributed that every one should be acquainted with this plant.

BLACK MEDIC
About one-half natural size

Its recognition is not difficult, though to distinguish it from the clover is sometimes confusing. Black medic is an annual plant with several prostrate stems radiating from the root. These are frequently three to twelve inches long and bear small alternate compound leaves composed of three leaflets borne at the summit of the leaf stalk. These three leaflets are inversely egg-shaped, with small teeth around the edge, and are decidedly cloverlike in appearance. Here and there along the stem clusters of flowers are borne in the axils of the leaves. These clusters, or heads, are composed of many minute yellow flowers, each individual flower having the structure of the pea blossom. Close inspection will show a bell-shaped calyx with five teeth on the margin; a yellow corolla composed of standard, wings, and keel like the pea. Inside are about ten stamens, the filaments of which are united side by side around the pistil. This membrane has split down on the upper side quite to the base, and one stamen located there is usually separate. The petals are often more or less fast to these stamens. The pistil is found within the stamen tube. It consists of a single ovary, style, and stigma. The fundamental structure of the pistil is exactly like that of the pea pod, but it has been reduced in size through the course of evolution until it is so short as to contain only a few seeds or even but one. The pod

is very much curved or coiled and when mature is black in color, which gives the name to the plant. It is by the coiled character of the pod alone that black medic is distinguished from clover by the botanist. One can soon learn to distinguish it, however, by minor differences in flowers and leaves. There are certain relatives of the black medic in which the coiled pod is exaggerated. These are sometimes cultivated in the Old World for the fruits, which are used simply as a joke, being placed in vegetable soup where they very closely resemble snails.

The black medic belongs to the pea family, and among its relatives are such well-known plants as clover, pea, bean, locust, vetch, and the like. The alfalfa belongs to the same genus as does the medic, but its pods are only slightly coiled.

TURNIP

Last year the beet was given for recognition. The turnip, like the beet, is a root crop, but it belongs to a wholly different family of plants. The beet is related to spinach and to such wild plants as lamb's-quarters, or pigweed. The relatives of the turnip are cabbage, cauliflower, mustard, radish, cress, and others.

Turnip seed may be sown as soon as the garden is ready. The seeds are small and round and flow easily, hence are usually sown much too thickly. The result is an over heavy stand, and it is necessary to spend much time at the tedious task of thinning. This should be guarded against at time of sowing. For fall use turnip seed may be sowed up to August 1. The roots so raised may be stored in a cellar or a pit, or they may be buried.

Rows should be fifteen to thirty or thirty-six inches apart, according to whether or not they are to be cultivated with horse tools. Thirty to forty seeds per foot are sufficient, and the little plants may be thinned to leave from four to eight per foot, according to earliness and the size desired.

The earliest turnips are flat, but for late use round ones are better. Many persons are fond of the yellow-fleshed swedes, or rutabagas, which are large and coarse looking, but a number of varieties of which are of excellent quality.

The turnip, like the beet, does not go to seed the first year, but may be stored over winter. The blossoms are like those of cabbage or mustard. The four petals give the name crucifer, or cross bearer, to the whole family of related plants.

SQUASH

The squash, the cucumber, the pumpkin, and both kinds of melons are cousins. For this reason many persons think that if any one of the first three is planted near melons, the quality of the latter will be spoiled

by crossing. Experiments have shown that this is not the case. Even though it were, the results would probably appear only in the crop raised from the seed so produced.

All the members of this family are injured by the slightest frost. Melons will not grow well in cool weather, but squash, cucumbers, and pumpkins can be matured in a short season.

The squash normally forms a long trailing vine, but certain summer varieties have been persuaded to grow upright. These are the bush squashes, and most of them are either saucer-shaped with scalloped edges, the pattypans, or very long and bent almost double, the crooknecks. The scalloped squashes are smooth skinned; the crooknecks are warty. Other squashes are egg-shaped, elliptical, round, or turban-shaped.

VARIOUS TYPES OF SUMMER SQUASH
Reduced in size

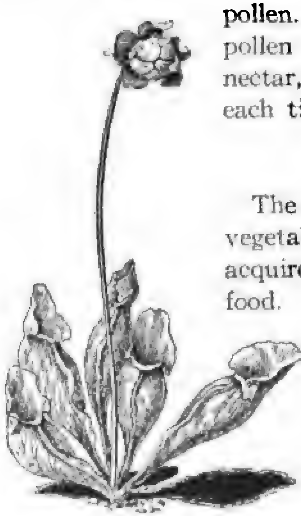
The most useful winter squash is the hubbard, which is warted and either deep green or rich orange yellow. Hubbard squashes may be kept in a warm cellar for several months.

Squashes will grow on almost any kind of soil, but they are happiest if there is an ample supply of well-rotted manure. A large forkful may be thoroughly mixed into the soil where each hill is to be. The hills should be four feet apart each way for the summer sorts and from seven to nine feet for the winter kinds. Eight or ten seeds should be placed in each hill about an inch deep. When the young plants begin to crowd, the hills should be thinned first to six plants and then to three, keeping the strongest.

Shortly after the thick fleshy oval leaves break ground, the hill is likely to be visited by small beetles with yellow and black stripes on their backs. They not only eat the squash leaves but carry plant diseases. Air-slaked lime or fine road dust or wood ashes may be sprinkled on the plants to keep the beetles off. Later the large squash bugs or stinkbugs

are likely to appear. The adults should be watched for and killed, also a lookout should be kept for the dark brown eggs, which are laid in little groups on the underside of the leaf. The little patch of leaf on which they are should be torn out and the eggs destroyed (page 127).

When the squash comes into bloom, it will be found that there are tiny squashes beneath some of the flowers only. The other flowers produce pollen. Bees will be discovered carrying the yellow pollen from one bloom to another as they seek the nectar, and thus they perform a service in fertilizing each tiny squash and enabling it to develop.



PITCHER PLANT
About one-sixth natural size

PITCHER PLANT

The pitcher plant is one of the curiosities of the vegetable kingdom. It is one of the plants that have acquired the habit of catching and digesting animal food. Since this animal food is mainly insects, such plants are termed insectivorous. This is a peculiar habit to be found among plants, and it shows how very specialized some plants may become. Such insectivorous plants, besides having mechanism for catching the insects, also secrete a digestive fluid, which is similar to that of animals. The fluid contains pepsins and other enzymes for making the food soluble. Glands are provided to secrete this liquid, and later the digested material is absorbed by means of these or other glands. The food absorbed is nitrogenous in nature, being composed of proteins and other similar compounds. Probably for this reason these plants are able to live in soils poor in nitrogenous material, such as bogs, sterile sandy soils, and similar places, of which they are characteristic.

The pitcher plant is found in the northern bogs, where it is one of the most striking inhabitants. It grows scattered in the peat moss, sending up its curious purple flowers from the rosette of still more curious leaves. These plants are fairly common in New York State, New England, and other parts of the continent. Other species are found in Florida and California.

The pitcher plant may be easily recognized. It is perennial with a basal cluster of tubular leaves from four to ten inches long and about one and one-half or even two inches in diameter. These leaves are broad above and taper gradually to the stalk. At the summit is a circular orifice with the border prolonged on one side into a flap, which is covered on the inside with downwardly directed bristles. The leaves are about half filled with water with the opening toward the sky. Insects fly into

the orifice and tumble down into the liquid below. The sides of the tube above the liquid are extremely smooth and polished. If the insect succeeds in crawling up the side of the tube, he encounters the recurved bristles, and his progress is materially retarded or obstructed. At length he usually falls back into the liquid. The insects so collected are attacked by the digestive fluids in the water and are dissolved and then taken up by the plant. The flowers are large, solitary, and purplish green, one borne at the summit of each long naked stalk, which is one to three feet high. The sepals are waxy. The petals are formed like a fiddle and converge over the flower. The stamens are very many, inserted around the base of the pistil. The ovary is compound, five-celled, and crowned with a short style, which spreads out above like an immense umbrella. The umbrella is nearly one inch broad and has five corners. Under each corner a stigma is located. The fruit of the pitcher plant is a many seeded capsule.

The pitcher plant belongs to the pitcher plant family. Its nearest relative is the sundew, another insectivorous plant, which by some botanists is associated with it in the same family, but the relationship is rather remote. On the whole, the pitcher plant is one of the most interesting and remarkable members of the wild flora.

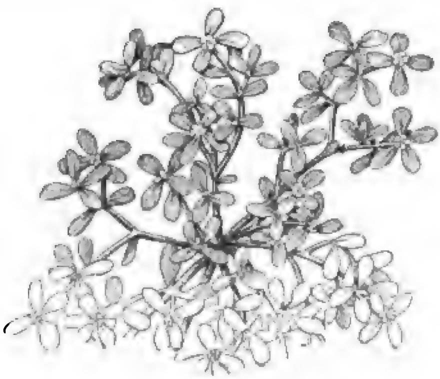
WEEDS FOR STUDY IN 1917-1918

K. M. Wiegand
Professor of Botany

PURSLANE

Purslane is frequently a bad weed in gardens and other cultivated ground, forming little patches close to the soil and often growing so rapidly that between hoeings the ground becomes badly overrun with the weed.

Purslane may be easily recognized by the fleshy nature of the foliage and the prostrate habit just mentioned. The stems are fleshy, six to eighteen inches long; the leaves are wedge shaped, about one-half inch long or less, very thick, and with entire margins. The surface is entirely smooth. The small yellow flowers are borne in open leafy clusters at the end



PURSLANE, "PUSLEY"
About one-third natural size

of the branches, each one being without an individual flower stalk. The flowers open for a short time each sunny morning, and are composed of two outside sepals, and from four to seven short yellow petals. The stamens are from six to ten in number. The pod at maturity is very characteristic, for it opens by a transverse rather than a vertical fissure, as the result of which the top falls off like the cover of a box, thus allowing the seeds to escape.

THE CANADA THISTLE
Plant about one-fifth natural size; leaf, flower, and fruit about one-half natural size

The purslane is a native of the Old World, where it was used in the early times as a potherb. It may have been introduced by the early settlers in this country for that purpose. It is now a common garden weed throughout eastern North America.

Since the plant is an annual, the methods of eradication and control are those applicable to most annuals. Constant hoeing when the plants are young, and care that the young plants are not allowed to mature seed, are usually sufficient to prevent a new infestation in the following season.

THISTLE

The thistle is so well known as a roadside and field weed to most persons that a description is almost unnecessary. It must be noted, however, that under this general head there are several distinct types recognized by the botanist, such as Canada thistle, bull thistle, pasture thistle, swamp thistle, and others.

Thistles may be recognized by the spiny foliage and certain flower characters. The leaves are more or less divided along the margin into lobes, each of which ends in a stiff spine. The foliage is usually hairy and sometimes, especially underneath, very white and woolly. These plants belong to the sunflower or daisy family, and therefore what appears to be a single flower is not really so, but is an aggregation of very many tiny flowers. For this reason, the name *composite* has been given to this family. These aggregations of flowers are called heads by the botanists. The thistle head is made up of many very small, slender, purple flowers. It possesses no rays like those of the daisy or the aster. The head is surrounded by many greenish scales, or bracts, which are often tipped with spines. The so-called seed of the thistle is not really a seed, but the tiny fruit of each individual flower, the solitary seed being borne inside each fruit. The little fruits are surmounted by a much modified calyx consisting of a tuft or circle of branched hairs, which are very useful in seed dissemination. These form a parachute by means of which the fruits are borne by the wind to great distances from the plant.

WILD CARROT
About one-quarter natural size

The *bull thistle* may be recognized by the large heads, spiny scales around the head, and long terminal segments to the leaves. The *pasture thistle* is similar, but has larger heads and short segments at the ends of the leaves. The *Canada thistle* has numerous small heads, without spines on the scales of the head, and without a slender terminal leaf segment.

The Canada thistle is the principal weed plant of this group, and causes the farmers great difficulty. It spreads by underground rootstocks, which are tenacious of life and as difficult to eradicate as those of the quack grass. It is common especially in grainfields, and the farmer should be very careful to see that his grain seed is free from the seeds of this pest. Eradication is very difficult. One

must plow, harrow, and rake out the roots several times during the season, and if possible seed the field down for a few seasons. The roots should be burned.

WILD CARROT

During recent years the wild carrot has spread rapidly through the eastern United States and has now become common in gravelly grass fields where the soil is not fertile. The meadows of many run-out farms have been transformed almost entirely into a pure growth of this unpleasant weed. Since it is not relished by cattle, it represents a distinct loss to the farmer, replacing as it does, the grass that otherwise might grow there.

COMMON PIGWEED, OR LAMB'S-QUARTERS

Reduced in size

Wild carrot, or Queen Anne's lace, as it is frequently called, can be recognized by its general habit of growth. It is one to three feet high, with scattered, finely divided leaves, and clusters of minute white flowers borne on the ends of branches. In these clusters the individual flowers are borne on slender pedicels that spring from a single point, such a cluster being called an umbel. The pedicels of these umbels arise in turn in the same way; and since the umbels are themselves arranged in umbels, the whole flower cluster is said to be a compound umbel. The arrangement of the flowers reminds one of the way ribs are borne in an umbrella, and the name *umbel* has been derived from this resemblance. At the base of the pedicels little bracts are borne, which help to give a feathery effect to the flowers. On close inspection each tiny flower will be found almost to lack a calyx but to possess five minute white petals, and five stamens, inserted on a seed-producing pistil in the center. The mature fruits are very small and dry. Each fruit splits finally into two parts in each of which a single seed is enclosed. The fruits bear tiny, hooked bristles, thus forming a sort of bur.

The wild carrot is an escaped and degenerated offshoot from the ordinary garden carrot; in fact it differs in no wise from the garden carrot except in the root, which is much more slender and scarcely at all fleshy. This weedy race has probably not come from the garden direct, but has been introduced from the Old World, where the carrot is native. The carrot is a biennial. The farmer should be very careful that seeds are not mixed with those of his other crops, especially with the grass seed. Infestation in a field may be much reduced by cutting the hay for several years

before the seeds of the carrot are ripe. In doing this it should be remembered that nearly mature seeds may finish ripening after the hay is cut. Another desirable method is to plow the hayfield and grow a cultivated crop for several years.

PIGWEED

Pigweeds are common and well known in gardens and by waysides throughout eastern North America. They are of two general sorts: the common pigweed and the so-called amaranth pigweed. Each of these groups is divided by the botanist into several distinct kinds.

AMARANTH PIGWEED, OR REDROOT
Reduced in size

The *common pigweed* may be recognized as a plant from two to five feet high with several or many ascending branches, and alternate, slightly fleshy, smooth, lance-shaped or egg-shaped leaves on distinct leafstalks. The margins may be entire or may possess several coarse teeth. Leaves, stems, and flowers usually bear minute, flourlike grains, which give them a mealy appearance. The tiny green flowers are borne in clusters covering the entire upper part of the plant, and are exceedingly numerous. There is no corolla, but the five green sepals enclose the four to five stamens and the ovary. This ovary contains, when ripe, a single seed, which soon breaks out of the membranelike ovary wall. The seed is shaped like a lens, or lentil, or, in other words, it is doubly convex. These seeds are black and shiny in color and less than one-sixteenth of an inch broad.

Amaranth pigweed is similar to the common pigweed in size and stature, but the leaves and the stems are somewhat hairy and without the little grains. Mixed with the flower clusters are small sharp-pointed bracts, which give the clusters of flowers a bristly and harsh appearance.

The flowers, the fruits, and the seeds are in all essential respects like those of the common pigweed.

FIELD BINDWEED
About one-third natural size

These plants are natives of the Old World and have been introduced into this country, probably by accident. The common pigweed, called often lamb's-quarters, has been used as a potherb. It may have been brought to this country for this purpose.

Pigweeds are annuals, and the method of control consists in preventing seed formation. In gardens this is done by continual hoeing and weeding. Thrifty farmers will see that pigweed does not grow in fence corners or in other waste places on their land. Compared with such plants as quack grass, Canada thistle, and orange hawkweed, pigweeds are easy to control.

BINDWEED

Bindweeds are well-known twining plants found along roadsides and in waste places in the latter part of the summer and in early autumn. Often they festoon the thickets along the stream banks or form large tangled masses along the roadside or in the garden. Bindweeds are of several kinds, which, from the botanical standpoint, are not closely related but belong to widely separated families. They are all called bindweed because they have the same habits, though their floral structure is different. They have alternate, petioled, egg-shaped leaves, which are usually sharp pointed, with entire margins, and heart shaped at the base. The two basal lobes often spread widely, such a leaf being called halberd-shaped.

BLACK BINDWEED
About one-third natural size

The *hedge bindweed* has flowers like a morning-glory and indeed belongs to the morning-glory family. The flowers are very large, two to three inches long, and white in color; the calyx is surrounded at the base by two broad bracts; the corolla is composed of five fused petals; there are five stamens and a single pistil, which, in fruit, produces a capsule full of large black seeds. The hedge

bindweed occurs in damp thickets or by roadsides, and is easy to recognize. It is perennial, and therefore the extermination depends on a careful grubbing out of the roots and the prevention of the formation of seed.

The *field bindweed* is also one of the morning-glory family, but the flowers are smaller than those of the hedge bindweed, about one to one and a half inches long, and the leaves are smaller and more oblong. The plant forms large, dense, prostrate patches in gardens and along roadsides. It is perennial with creeping rootstocks, and, like the Canada thistle and quack grass, is a very difficult plant to eradicate. As a weed, this bindweed is the worst of the group and should be banished at once.

The *black bindweed* and its relatives belong to the buckwheat family, and their tiny fruits so much resemble those of the buckwheat that there will be no difficulty in recognizing them. The flowers are small and inconspicuous, without corolla, composed of five sepals, five to eight stamens, and a single pistil. Each pistil matures a single one-seeded fruit, which is sharply three angled.

Black bindweeds are common in cultivated ground especially in gardens and along the roadside. They are frequently found on railway embankments where the soil is not too sterile. The plant is an annual, and therefore can be controlled by frequent cultivation in order that no seeds may be allowed to mature. The seeds of this plant are frequently found mixed with commercial seeds of various sorts, and as a preventive measure attention to pure seed is of primary importance.

PLANT QUOTATIONS

FLOWERS

What's a flower. A bit of brightness
  Sprung unconscious from the sod,
Yet it lifts us by its lightness
  From our earthliness to God.

By B. H. R. GOODALE

WILLOW

See the soft green willow springing
Where the waters gently pass,
Every way her free arms flinging
O'er the moist and reedy grass.
Long ere winter blasts are fled,
See her tipped with vernal red,
And her kindly flower displayed
Ere her leaf can cast a shade.

By JOHN KEBLE

DAISY

The air is sweet with a strange perfume,
  That comes from the depths of the woodland places,
The hills are hid in a wealth of bloom,
  And white with the sweep of the ox-eye daisies!

* * * * *

Clear and simple in white and gold,
  Meadow blossom of sunlit spaces,—
The field is full as it well can hold,
  And white with the drift of the ox-eye daisies!

From *Daisies*
by DORA READ GOODALE

MARSH MARIGOLD

Suppose the little cowslip
Should hang its golden cup,
And say, "I'm such a tiny flower,
I'd better not grow up";
How many a weary traveler
Would miss its fragrant smell;
And many a little child would grieve
To lose it from the dell.

SELECTED

TRILLIUM

A white-faced maid, Wake-robin,
  In a tiny, three-leaved hood,
Knows many of earth's secrets
  While nodding in the wood.

By RAY LAURANCE

ANEMONE

Wind-flower, Wind-flower, why are you here?
This is the boisterous time of the year
For blossoms as fragile and tender as you
To be out on the roadside in spring raiment new;
For snowflakes yet flutter abroad in the air,
And the sleet and the tempest are weary to bear;
Have you not come here, pale darling, too soon?
You would seem more at home with the flowers of June.

From *The Wind-flower*
by LUCY LARCOM

PARTRIDGE BERRY

Made glad with springtime fancies pearly white,
Two tender blossoms on a single stem
In their sweet coral fruitage close unite
As rounded bead cut from a garnet red;
And all the year the vine uplifting them,
  Creeps on with cautious tread,
  As if between soft palms
  Its treasure safe from harms
  Was borne above its head.

From *Mitchella; Partridge-berry*
by ISAAC BASSETT CHOATE

BINDWEED

In the deep shadow of the porch
  A slender bind-weed springs,
And climbs, like airy acrobat,
  The trellises, and swings
And dances in the golden sun
  In fairy loops and rings.

From *Bind-weed*
by SUSAN COOLIDGE

THISTLE

Set loose from summer's churlish hand,
  All day they pass my door;
White voyagers to no man's land,
  To ports without a shore.

From *Thistledown*
by LIZETTE WOODWORTH REESE

WILD CARROT

Gauzy gowned in fairy network
  And caps of finest lace,
Dames colonial of the roadside
  In the summer find a place,
In nature's glad procession,
  That pay all homage due
To their wise and bounteous mother,
  They're proud and loyal too!

From *Wild Carrot*
by RAY LAURANCE

TREE STUDY

THE EDITOR

TREES abound everywhere. Even in the midst of great cities one does not have to travel far to find trees with which he can associate, and which he can come to know in all seasons. The study of trees lends itself to every time of the year, and as the seasons come and go trees present many varying phases, each with its special interest. There are the leaves, the blossoms, the fruit, the twigs and buds, the bark, the wood, the distinctive tree forms — all of which vary for the different species and thus offer abundant material for interesting and profitable study.

The locust is given for special study during the year 1917–1918, and it is probable that most schools will be able to find somewhere in the neighborhood a locust tree that can be studied. If this is out of the question, however, some one of the more important trees in the neighborhood should be given special attention. Some years ago the maple tree was given for special study, and material was presented in the leaflet. The following statement from a teacher relates the progress of the study of the maple in her school, and is one of the best illustrations that could be obtained of the way in which such work should develop naturally:

Last year we made a special study of the maples found in New York State. We began with the sugar maple growing in our school yard. We drew the leaves and the fruit. The children already knew some facts about it. We found more in the leaflet. Specimens of leaves were selected and pressed.

Now the search began for others. It was not long before the red maple was found growing along the bank of a near-by stream. Leaves were brought in and compared with those of the sugar maple and the differences in sinuses especially noted. Again the leaflet aided us. We added this maple to the collection.

Not long after, some of the children discovered the silver maple growing along the streets of the near-by village. We spent some time in getting characteristics and selecting specimens for pressing.

Not far from the schoolhouse we had for some time noticed a maple tree the seeds of which differed from those of the sugar maple although the leaves were quite similar in shape. After much investigation we decided to call it the Norway maple.

As we worked the interest became more intense, and you can imagine with what joy we hailed great clusters of maple seeds found growing on a comparatively small tree that we discovered in a village cemetery. Again the leaflet helped us name the ash-leafed maple.

Late in the fall during our walks we found the two maple shrubs — moosewood distinguished by the white markings on the bark, and the mountain by the clusters of characteristic seeds. Now our pressed collection contained seven specimens.

One Friday afternoon in December we mounted our collections, and the joy and the pride felt by the children over the finished mounts was alone worth the work.

While searching for the maples other trees came in for their share of recognition. Several of the poplars were found, all the birches, and two locusts. We learned to distinguish black and white oak, but could not safely determine the species of each group. We hunted for the English elm, but were unable to find one.

We have yet much to do to be able to know the trees about us.

The trees for recognition in 1917–1918 include hemlock, spruce, cherry, quince, horse-chestnut, alder, elm, poplar, and tamarack. It is stipulated that a study shall be made of one conifer and of two fruit trees. Of course, some other fruit trees than the cherry and the quince may be taken, and it might be specially desirable to review some of the work that was done last year on the apple, for this is a subject that could be discussed to advantage in the school each year, concentrating on some one phase at a time.

In speaking of the different aspects of the tree work two teachers wrote as follows:

Last week we took up the study of trees — their buds and manner of budding. Following the suggestion in our last Cornell leaflet, we noticed whether the buds were opposite, alternate, or whorled. We also took mental notes of the size, the shape, and the color of the buds. In just two days we were able to recognize the twigs of thirty-eight different trees. We did not have a class; the buds were simply passed around from desk to desk until each child knew each one at a glance. In a few days we are planning to take a field trip in order to study the bark of trees and their manner of branching. One can get this much better by contact with nature herself than by the use of books. Of course, books have their place in reference work.

Last fall we made a leaf and plant press, found leaves from all the various trees in the neighborhood, pressed them, and mounted them in a leaf book. For this I used a catalogue of a large girls' college, containing pictures that were interesting and in sepia color on good cream-tinted paper. It had leaves of thin, plain paper between the printed pages and good covers. It happened to have a beech tree on the front cover. The leaves after pressing were mounted on drawing paper, covered with a thin coating of melted paraffin put on with a brush, and then pasted over the pictures (upper edge only) in the book. We nearly filled the book, which made a very pretty book of leaves in autumn colors. We used them later for drawing purposes and in connection with our winter study of trees.

Teachers in cities can utilize trees in the parks and shade trees. In the parks there are usually a good many imported species about which it may be possible and worth while to learn. One teacher in a small city made mention of the work as follows:

Our town is noted for the beauty of its shade trees. These are the trees we study, and I include the insect pests to which they are subject and the methods of fighting them, also a little work on the fungi that are likely to attack trees. I wish to impress on the children a sense of the beauty of these trees, the addition they are to our town, the necessity of caring for them, and the desirability of replacing those that die. I also force branches of fruit trees and others in jars of water in the windows and watch the expanding buds.

Tree mounts, such as the one shown on page 308, are valuable for records and for the experience that comes to the children in preparing them, and they lend themselves very well to exhibit purposes. It is much better to have a complete record of each tree, showing all its phases, though a temporary mount can be made, for example, of leaves, or twigs, or bark, or wood, by mounting typical specimens of each side by side. It should always be borne in mind in collecting tree specimens that trees should not be mutilated, and children may be brought to appreciate the time that it takes to grow a tree.

All local facilities in the way of sawmills, carpenter shops, and wood factories should be used to familiarize the children with the phases of tree work that relate particularly to the uses of wood. It would be specially desirable to have children learn to recognize the different kinds of wood as they see them used in furniture and in interior decoration.

Teachers are urged to refer to the article on page 245 of the September 1915 leaflet, entitled *Forestry in the Rural Schools*. There are still a few copies of this leaflet available, which, on application, will be sent to those who do not have access to a copy.

LOCUST

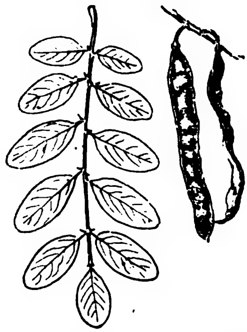
(For special study)

John Bentley, Jr.
Assistant Professor of Forestry

The locust tree is one of the broad-leaved trees. The cone-bearing trees furnish a very large proportion of the timber used in this country, and the hardwoods, or broad-leaved trees, are perhaps not so generally useful. For certain purposes, however, the carpenter or the builder frequently has to turn to the hardwoods for what he wants, either for hardness or durability or for the beautiful grain and satinlike finish of which hardwoods are capable. A handsome piece of mahogany or curly birch or bird's-eye maple is certainly much better suited to the making of fine furniture and the interior finishing of a house than is spruce or pine. Each class of trees has its own uses. Pines, spruces, and firs are especially useful in construction work and framework, for which such qualities as strength, medium weight, and durability are required. The hardwoods are chosen for finishing and trimming, as well as for furniture and cabinet making, in which beauty and elegance are desired in addition to strength.

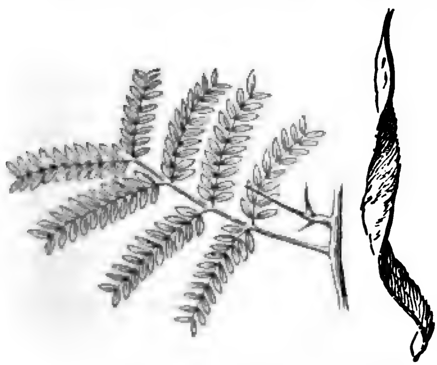
Unfortunately, not all hardwoods are equally attractive, even when carefully worked and smoothly polished. In order to be handsome and

useful for furniture or interior finish, a wood must possess a certain degree of hardness, so that it will take a fine polish; and in addition to this, it should have a rich color, or a well-marked grain, or both. White oak, sycamore, mahogany, birch, red gum, black cherry, and maple when it has a curly or a bird's-eye grain, are all much used for furniture or interior finish and for panel work; while beech, chestnut, elm, basswood, hickory, locust, and a great many others are not so much used for these purposes, but are nevertheless very useful for special purposes because of the toughness or the hardness of their wood. The locust is especially useful for posts, poles, ship timbers, or any other purpose that demands toughness and strength combined with durability in contact with moisture. Many woods decay rapidly when they are subjected to the moisture in the ground or to the ordinary changes in the weather. A good quality of the locust, however, is its durability, especially when in contact with the soil or exposed to the weather. Some of the great railroad companies, which use each year many thousands of railroad ties, have recognized the durability of the locust and are growing and cultivating locust trees on their own land to supply ties, posts, and poles.



COMMON LOCUST, LEAF AND FRUIT
About one-fourth natural size

The locust is a member of the legume family which is very useful to man. This family includes many plants whose fruit or seeds are edible and supply food for man and beast. Peas, beans, and lentils are used by man as food, and they are very valuable indeed because they are so rich in proteids. The locust tree, true to the characteristics of its family, bears fruit consisting of a number of dark orange-brown seeds about three-sixteenths of an inch long and usually with irregular darker markings, enclosed in a reddish brown pod three to four inches long. The presence of the pods, which persist from the time they ripen in the fall until early spring, is one of the distinguishing characteristics of the locust. In the spring the tree may be recognized and identified by its foliage and its flowers. The leaves are



HONEY LOCUST, LEAF AND FRUIT
About one-eighth natural size

eight to fourteen inches long, with seven to nineteen leaflets, making what the botanists call a compound leaf — that is, a large leaf composed of several smaller leaflets all growing from the same stem. The leaflets are one-half to three-fourths inch broad, about one and one-half inches long, and generally have a perfectly smooth edge. They are dull dark green above while the under surface is paler, and in the fall they turn to a clear yellow. The flowers, which appear late in May or about the first of June, are borne in loose, drooping clusters; they are creamy white and very fragrant. A locust tree in full bloom is indeed a very beautiful sight.

Where the soil is good, the locust tree grows very rapidly when young. It puts out many roots in all directions, which seek the moisture in the soil. Frequently they are so close to the surface of the ground that a number of shoots are sent out. These soon grow and make a thicket of young locust trees. These young trees are very attractive, but they use up a great deal of the moisture in the ground. If therefore, the old tree is to grow to good size, it is well to cut the sprouts each year and to keep the ground near the parent tree clear. When a number of locust trees are growing together and are all of about the same age, as in a plantation, there will not be so many sprouts.

A HONEY LOCUST TREE IN WINTER

The young locust tree grows very rapidly, and at the same time the wood that it produces is hard, strong, and heavy, and is usually a pale yellowish brown in color.

The locust tree has an enemy that often destroys it — the locust borer (*Cyllene robiniæ*), an insect that does its destructive work in the form of a grub. It bores holes in the trunk and branches, keeps the tree from growing as it should when in a healthy condition, and may destroy it. In September the beetles — which are about three-fourths of an inch long and of a velvety black color with bright golden yellow markings — gather in large numbers on the bark of the locust trees and lay their small white eggs in the crevices of the bark, in clusters of seven or eight. These eggs

A COMMON LOCUST TREE IN WINTER

soon hatch into little grubs, or worms, of a yellowish color, about three-fourths of an inch long. They gnaw their way to the outer layer of the living inner bark, where they rest snugly through the winter. The warm weather of spring revives them, and they begin work in April or May even more vigorously. They extend their burrows into the wood of the tree, sending out chips and sawdust, by which their work is often detected. The grubs become full-grown about the middle of July, at which time they go through the metamorphosis common to beetles and emerge early in September as beetles.

Professor G. W. Herrick, of the Department of Entomology, has the following to say in regard to the control of the locust borer:

"Borers are always hard to control because it is not easy to reach them in their burrows especially when the latter are deep in the wood. There is, however, one weak point in the life history of the locust borer, and that is the habit the young grubs have of burrowing just beneath the dead outer bark and there stopping to pass the winter. Here they can be reached from the outside by spraying the trees not earlier than November 1 and not later than April 1 with a twenty-per-cent kerosene emulsion. This method of controlling the locust borer is applicable in the case of shade trees and small groves of trees. The management of locust plantations to prevent losses by this insect is too complicated a matter to discuss here, but it is fully explained in Circular No. 83, entitled *The Locust Borer and Methods for Its Control*, issued by the United States Bureau of Entomology. A copy of this circular may be obtained by writing to the United States Department of Agriculture, Washington, D. C."

If the locust tree is cared for and protected against these borers, it should soon become large enough for fence posts.

SUGGESTIONS FOR STUDY

Some of the points on which the children should be encouraged to make and report their own observations are the following:

1. Compare the locust tree with other forest trees as to the following points: size; bark, rough or smooth; the presence of thorns or spines.

2. What sort of a root system does the locust tree have? Will this be of any help to it in withstanding strong wind and storms?

3. Notice the flowers of the locust tree when it blooms about the first of June. What do they resemble? Compare the blossoms of the locust tree with the blossoms of the common sweet pea of the garden. In the fall gather some of the pods which have ripened from the blossoms. How many seeds are there in the pods? Compare the fruit with the pea or the bean.

4. Notice the leaflets of the locust on a bright, sunny day, and then on a still night notice how they have folded together; or in cloudy, cold,

or rainy weather, see how the leaflets behave. It is one of the habits of members of the legume family to fold their leaves together at night. Find other examples.

5. In winter notice how the buds, which contain the beginnings of next summer's leaves, are protected by being depressed and having a scalelike covering, the inside of which is lined with a woolly growth. The tree makes all this careful preparation against cold weather, which might injure the tender leaves in the buds.

6. How fast does a locust tree grow in diameter? Make observations on a freshly cut stump. What does each ring represent?

7. Is the bark on a locust tree thick or thin? What effect does this bark have on making the locust tree able to resist light ground fires? The purpose of the bark is to protect the growing part of the tree, which is just under the bark. The sap carries water and plant-foods from the roots to the leaves and from the leaves to the growing parts of the tree. That is why it is so important to keep the bark from being injured, for if the bark is cut or bruised or bored into by insects, the tree loses sap and is weakened.

8. Soak some seeds of the locust in hot water, not boiling but about 135° to 150° F., for several hours. Do this for three or four successive days, or until the seeds swell, taking care not to let them dry out at any time. Plant them in soil in a box that can be kept in a warm, sunny place, and compare them with seeds sown at the same time but not previously soaked in hot water. Keep the soil in which they are planted moist. See how many days it takes for the soaked seeds to germinate. Have the seeds that were not soaked begun to show signs of germinating? How do you account for the success of locust trees in growing from seed in nature?

9. The presence of nodules on the roots of legumes is a family characteristic. Look on the fibrous roots of young locust trees and see whether you can find nodules. What is the function of the nodules?

TREES

A thousand miles of mighty wood,
Where thunderstorms stride fire-shod;
A thousand plants at every rod,
A stately tree at every rood;
Ten thousand leaves to every tree,
And each a miracle to me,—
Yet there be men who doubt of God!

By JOAQUIN MILLER

TREES TO BE RECOGNIZED IN 1917-1918

JOHN BENTLEY, JR.
Assistant Professor of Forestry

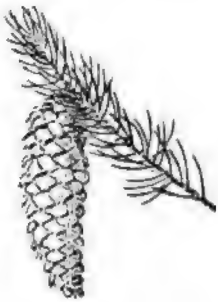
HEMLOCK

The hemlock tree, which is common on shady, moist, northern slopes or in deep, cool ravines, is useful both for its wood and for its bark. Many years ago, when it was more plentiful on the hills and mountains of central and northern New York, it was cut in large quantities for its bark, which is very rich in a certain kind of acid much used in tanning leather. Large trees were cut down and stripped of their bark, while the trunks of the trees were left in the woods to decay. This was because other woods were considered more valuable, and no one wanted hemlock lumber. But in recent years, when pine and spruce are becoming more scarce, and all lumber is going up in price, the hemlock is being used for lumber. The wood is not quite so strong as that of pine or spruce, and it has the bad quality of being very splintery; but nevertheless it is useful when made into joists and other timbers of considerable size used in the framework of buildings.

HEMLOCK

The hemlock is a very slow-growing tree, often requiring two hundred years to reach a diameter of sixteen to eighteen inches. This is the result of its growing in shady places, where but little sunlight can reach it. All trees require sunlight for their growth, and if the supply of light is small, the growth is slow. Hemlock, however, will get along with much less light than pine, or birch, or many of the other trees with which it is often associated; it waits until it has a chance to push its head above the others, and then frequently overtops them and lives to a great age.

The hemlock is one of the conifers, or cone-bearing trees. The cones are much smaller than those of pine or spruce, being only from about one-half to one inch in length, and usually are borne near the top of the tree. The needles are short and flat, and green on the upper surface, while the under surface is silvery white. By means of the cones and the needles, it is easily possible to distinguish the hemlock from pines, spruces, and firs.



NORWAY SPRUCE CONE
About one-fourth natural size

SPRUCE

One of the commonest spruces in the eastern part of the United States is the Norway spruce, which is not native to this country but has been introduced from Europe. It grows in a larger variety of soils and is more useful than the native species for planting in parks and lawns, which accounts for its great abundance.

The native spruces, however, are exceedingly useful, and, although they are not commonly seen, except in the mountains or in cold, deep swamps, they contribute wood and lumber to some of the most important industries. The red spruce, which is found in the mountains of the northern part of the country and is also widely distributed in Canada produces wood that is very useful for the manufacture of paper pulp. Most of the daily newspapers are printed on stock made from spruce pulp. For certain uses, such as sounding boards for musical instruments, and for timbers where great strength combined with lightness is required, the spruce is one of the best trees.

NORWAY SPRUCE

The Norway spruce has a very long cone compared with the native spruces, and it can always be distinguished from them by this characteristic. All spruces have short four-sided needlelike leaves, set singly on all sides of the twig.

CHERRY

The cherry is described on page 207.

QUINCE

The quince is described on page 208.

HORSE-CHESTNUT

The horse-chestnut, which is very common in parks and along streets, belongs to a family that has some species native to the Southern and the Western States. But the horse-chestnut itself, which is the largest tree of the family, comes from Europe. It has large, compound leaves with seven leaflets growing from a common point, rather than distributed along a central stem, as is the case in locust, ash, butternut, and walnut. In the spring the horse-chestnut produces beautiful flowers, and it is on this account that the tree is such a favorite for ornamental planting. A horse-chestnut tree in full bloom is a beautiful sight. The large nuts, which ripen in the fall, are well known to all boys and girls, but are not edible as are the nuts of the native chestnut.

HORSE-CHESTNUT, LEAVES AND FRUIT
About one-fourth natural size

The wood of the horse-chestnut is light both in color and in weight, is weak, and does not last long when exposed to weather. It therefore has little use as lumber. The European horse-chestnut has some closely related species in this country, however, which produce wood useful in the arts and sciences. The commonest and largest of these is the buckeye, which grows in the Mississippi Valley.

ALDER

Many of the small streams have growing along their banks a dense undergrowth of willows and alders. The alder is a member of the birch family, and its leaves resemble those of birches but are usually more rounded at the end. Another noticeable feature of the alder is the presence of catkins, which are formed in the late summer but which remain in a dormant condition until the following

ALDER LEAVES, CATKINS, AND FRUITS
About one-fourth natural size

spring. The pistillate flowers are formed in the spring and after being fertilized develop into small fruits, which resemble very small pine cones. Native alders do not reach tree size or form. They serve a useful purpose, however, in that they grow along the streams in such numbers that the roots hold the soil of the banks and often help to prevent it from being washed away by floods.

The black alder, a species from Europe, has been planted in this country, and it has been reported as escaped from cultivation in some places. In contrast to the native alder the European black alder has a treelike habit of growth and under favorable conditions reaches a height of fifty feet. This habit of growth and the fact that it is found more often at some little distance from streams serves to distinguish it from the native alder.

HORSE-CHESTNUT BLOSSOMS
About one-half natural size

ELM

The elm tree is one of the largest and most graceful of the trees native to New York State. It is also one of the most familiar trees to boys and girls. The reason for this is that the elm is a tree of the farms, the home lawns, and the streets of towns rather than a tree of the deep woods. While it is sometimes found in the forest, it is generally scattered among other trees and never forms any large part of the forest as do maples, birches, pines, or oaks.

The elm has a very distinctive form and habit of growth. Other trees seen from a distance are not always easy to recognize, but the elm with its massive trunk, which usually breaks up into several large branches

and these into delicate twigs and branchlets, takes a triangular or vase-shaped form which is easy to recognize even at some little distance.

ELM LEAVES AND FRUIT
About one-fourth natural size

The elm tree, large as it is, springs from a very small seed. The seeds are short lived; and unless they fall on soil that makes a good seedbed and germinate immediately, they die. One of the things to remember about the elm is that it blossoms and produces seeds very early in the spring. The seeds have winged margins, and the wings have sharp points and are curved at the apex so as to make a kind of notch. Most trees, such as hickories, pines, and oaks, do not ripen their seed until fall, but the elm and the soft maple are two of the notable exceptions to this general rule.

It is difficult to say whether the elm is more beautiful in summer or in winter. In summer the dense foliage hangs in long, graceful sprays from the branches, swaying in the breeze and making a delightful shade. In winter the elm shows its strength — not the rugged strength of the oak, but a supple, graceful strength, suggestive of reserve force. It is in the winter, too, that the delicacy of the smaller branches is seen to best advantage. Every wind sways them, but they do not break; they yield gracefully and seem to enjoy the storms of winter.

ELM IN SUMMER

The wood of the elm is useful where great toughness and strength are essential. It is used in making barrels and fruit baskets, but is very hard to split and work, and

for this reason carpenters and woodworkers do not care to use it when wood of another kind will do.

POPLAR

The common poplar of the eastern part of the United States is the so-called quaking aspen, which is remarkable for being one of the most widely distributed trees native to this country. It is found from the Atlantic to the Pacific and from elevations near sea level to elevations of more than 10,000 feet in the highest of the Rocky Mountains of the West. It also extends from Mexico to Alaska, and, although never growing to a very large size, is a useful tree in many ways. It has light green foliage that trembles at the slightest breeze, giving rise to its name *quaking aspen*. In the West it serves a useful purpose in reclaiming the mountain sides that have been swept by fires and establishing a growth long before any other tree is able to get a foothold. Later, when the aspens have grown to a height of fifteen or twenty feet, other trees, such as the spruces and the firs, begin to creep in, and they profit by the shelter and protection of the aspens.

POPLAR LEAVES AND FRUIT
About one-half natural size

In the East the poplar never grows to very large size but is useful as a source of wood for making small articles and for paper pulp. The wood of the aspen is light and not strong, but burns with a quick, hot fire and in the West particularly is often used by campers for cooking their meals.

Besides the quaking aspen, there are likely to be found in New York State the large-toothed aspen, the balm of Gilead, or tacamahac, with its sticky buds, the white poplar, and the lombardy poplar. The last two are not native, and the lombardy is very distinctive for its tall, slim shape. The leaf stems of all poplars are flattened where they join the leaf at right angles to the leaf blade, and this makes the leaves very sensitive to breezes.

TAMARACK, OR LARCH, LEAVES AND FRUIT
About one-half natural size

TAMARACK, OR LARCH

The tamarack, or larch, is distinguished from other cone-bearing trees by the little clusters of needlelike leaves. These clusters contain ten or more needles, which fall off at the end of the growing season just as do the leaves of the broad-leaved trees. The young leaves come out in the

spring about the same time that leaves are appearing on other native trees, but even when full grown the foliage has a sparse, fringelike appearance that gives very little shade.

The native tamarack is a tree of the cold, deep swamps of the North. About twenty-five years ago great numbers of them were killed by an insect called the larch sawfly, so that at present it is difficult to find many full-grown trees. If no further losses are incurred the tree should rapidly regain possession of many of the swamps in the north woods and continue to furnish a wood that is durable, strong, and heavy. It does not grow so fast as the pine, but for certain purposes, where durability is important, it is a very useful wood.

A species of larch from Europe, which grows in drier situations, is frequently planted in parks and gardens. This has much the same appearance, but has larger cones than the native species. The wood has about the same characteristics, and the tree has been planted rather extensively in this country.

About the time that the leaves are coming out in early May, the flowers of the tamarack are very beautiful and are worthy of close inspection. The male, or staminate, flowers have many yellowish anthers on short stalks arranged spirally. The female, or pistillate, flowers are composed of many rose-red scales, also arranged spirally, and are accompanied by rose-colored bracts with long green tips.

TWO FRUIT TREES FOR RECOGNITION IN 1917-1918

H. B. Knapp
Formerly Assistant Professor of Pomology

CHERRY

THE cultivated cherry is not a native of this country; it came from southeastern Europe, where many of our fruits originated. There are many species of the cherry growing wild in the United States. A few of these give promise of being useful and valuable some day, but as yet they do not compare with those from the Old World.

This fruit is steadily growing in importance. There are already a large number of cherry orchards in western New York and in other sections of the United States. The fruit is used chiefly for canning, and is very delicious for this purpose.

Cherries may be divided into two groups — the sweet and the sour. The trees differ greatly in appearance and in habits of growth. The sweet cherries are large, vigorous, upright-growing trees with reddish brown bark, which separates in rings. The flowers appear at the same time as the leaves. The sour cherries are low-growing trees with spreading, bushy heads, much resembling in size and shape the head of the peach tree. The flowers appear before the leaves. It is the sour cherry that is chiefly grown on a commercial scale, although the sweet cherry is gaining in favor for this purpose.

Both sweet and sour cherries are divided into groups, and these groups in turn are made up of different varieties. There are three distinct groups of sweet cherries: the *Mazzards*, which grow wild in the eastern United States, not desirable in themselves but furnishing good stocks for other groups; the *Hearts*, large, soft, heart-shaped cherries, either light or dark in color, represented by the Black Tartarian and Governor Wood; the *Bigarreaus*, also heart-shaped, but very firm and meaty, the Napoleon Bigarreau being a common variety. There are also the *Dukes*, which Dr. Hedrick, of the Geneva Experiment Station, finds to be a group of hybrids between the sweet and the sour cherries. Among the best of these are the May Duke and the Reine Hortense. These classes have been mixed by crossing, until now it is very difficult in many cases to tell in which group a variety belongs.

The sour cherries are separated into the *Amarelles* and the *Morellos*. The Amarelles are light red cherries with uncolored juice, the Early Richmond and Montmorency being well-known varieties. The Morellos are dark red, more acid than the Amarelles, and have a colored juice. The English Morello, grown for so many years, belongs to this last-named group.

The cherry is propagated by budding, in the same way as are the apple and the pear. The stocks used are the Mazzard, which has been mentioned, and the Mahaleb, a European species. Of the two stocks the Mazzard is the better, because it makes a larger, more vigorous tree. The nurseryman prefers to use the Mahaleb, however, as it effects a union with the scion more readily and does better in the nursery row. Cherry trees are usually set out at two years from the bud, although one-year-old trees may be used. Sour cherries are set sixteen to eighteen feet apart, and the larger-growing sweet cherries are planted twenty-five to thirty feet apart.

The tree does not require much pruning. Most of the fruit is borne on spurs on two- or three-year wood, although spurs are found on much older wood. Some fruit is often found at the base of the one-year wood, and these cherries are usually the largest and best. These do not grow on spurs, but come from a single bud; consequently, as soon as the fruit is borne, no further growth takes place. This accounts for the long, bare spaces often found at the base of the one-year wood. In general, it is best not to encourage a large amount of wood growth in a single year, and since heavy pruning induces wood growth, cherries should be pruned but lightly. Three to five branches are used to form the head. In the sweet cherry the central-growing shoot, or leader, is removed, in order to keep the head as close to the ground as possible. The head of the sour cherry is thinned out and cut back but little.

Cherries thrive in warm, well-drained soil that is not too heavy. A gravel is suitable for most varieties, although the sour cherries do better on the heavier soils than do the sweet cherries. Clean culture should always be practiced. The cultivation should be shallow, as the roots are close to the surface. A cover crop should be sown in midsummer, to remain on the ground until the following spring.

Cherries are picked a few days before they are fully ripe. They should always be picked with the stems on unless they are to be canned at once. They should be gathered by the stems instead of by the fruit. The small, one-quart baskets are commonly used, and these are placed in larger packages.

The cherry tree will thrive with as little care as any fruit trees, and responds as readily to skillful treatment. It should be planted on every farm or in every garden.

QUINCE

The quince is not a native of this country, its first home being in Asia and southeastern Europe. It has been known and used for at least two thousand years. In spite of this fact, the fruit does not compare in importance with other common fruits, such as the apple, the pear, the

peach, the cherry, and the plum. This may be explained in part by the fact that the quince is not a pleasant nor an agreeable fruit to eat in its fresh or raw state. It is used chiefly for canning and making jelly.

The quince is a short, bushy-growing plant, seldom reaching a height of more than fifteen feet. If allowed to grow as it will, it often resembles a bush more than a tree, but by careful pruning the tree shape may be obtained. The growth each year is short and much twisted and distorted, unlike the straight, shapely shoots of the cherry and the peach. The leaves are oval, dark green above, and downy below. The quince is very closely related to the apple and the pear, belonging to the same family, but it is not quite so hardy as these fruits. The fruit is five-celled, like that of the apple and the pear, and contains several seeds in each cell. All the fruit is borne on wood of the same season's growth. In other words, when the buds begin growth in the spring they form leafy shoots, and on these shoots the blossoms soon appear. The flowers, which are borne singly, resemble closely those of the apple, but are larger and more showy. They shade from pure white to a distinct pink, and are so attractive that the quince is sometimes kept for a flowering shrub.

QUINCE FRUIT
About one-half natural size

The quince thrives best in a rich, rather moist but well-drained soil that contains a small amount of clay. Sandy soils are not so suitable, as they dry out very quickly. The young trees should be set twelve to fifteen feet apart, depending on the variety and the richness of the soil. Clean culture should always be practiced, but cultivation should cease shortly after midsummer, in order that the wood may be mature and hard before cold weather comes. It is always well to sow a cover crop of rye, buckwheat, or cowpeas, to remain on the ground during the winter and protect the roots, which are very close to the surface.

The quince is propagated in a number of ways. One of the most common methods is by budding, as with the apple and the pear. Another common method is by mound layering, which is performed in the following manner: In the spring the bush is cut back so severely that many new shoots are sent out during the summer. The next spring, the earth is

heaped or mounded around these shoots, leaving but a few inches above the surface of the soil. These shoots take root, and the following fall or spring they are separated from the parent plant and set out.

The pruning consists in keeping the head fairly open to air and sunlight and in cutting the young wood back each year in order to thin the fruit and to insure a good growth of wood for the succeeding season.

The fruit is extremely tender, bruising very easily, and therefore must be handled with great care. It ripens at about the same time as the pear, or even later. It is marketed in peck baskets, in bushel kegs, or in half-barrels. The most common varieties are the Orange, the Champion, and the Rea.

The quince is easy to grow and should be planted in every home garden.

TREE QUOTATIONS

TREE PLANTING

He who plants a tree —
He plants a love;
Tents of coolness spreading out above
Wayfarers, he may not live to see.
Gifts that grow are best;
Hands that bless are blest;
Plant! Life does the rest!
Heaven and earth help him who plants a tree,
And his work its own reward shall be.

From *Plant a Tree*
by LUCY LARCOM

HEMLOCK

O hemlock tree! O hemlock tree! how
faithful are thy branches!
Green not alone in summer time,
But in the winter's frost and rime!
O hemlock tree! O hemlock tree! how
faithful are thy branches!

From *The Hemlock Tree*
A translation from the German
by HENRY WADSWORTH LONGFELLOW

ELM

Where mellow haze the hill's sharp outline dims,
Bare elms, like sentinels, watch silently,
The delicate tracery of their slender limbs
Pencilled in purple on the saffron sky.

By ELIZABETH AKERS

PART II

HOME MAKING

The Editor

Each year the many phases of home making are finding more and more place in elementary schools. This division of the nature study work has developed a little more slowly than those in natural history and in agriculture, but it is one that is full of interest and that has the closest possible connection with our daily lives.

Last year, for the first time, a section of the September leaflet was devoted to home making, and this will be continued in future. As yet it has not been possible to obtain material on any wide range of topics in a given year, and perhaps this is not so necessary as it might at first thought appear. First of all, the foundation must be laid, and we are very fortunate this year in having a complete presentation of the subject of sewing, involving the different stitches and operations, with suggestions

as to their application, some discussion of the question of repair work, and suggestions for a number of constructive problems. This material should provide a basis for beginning work in sewing, which many teachers have wished to do, and which some have already done successfully.

Because of the amount of the material on sewing, it has not been possible to include in the leaflet subject matter on other phases of home making, but attention is called again to the articles that were issued in the September 1916 leaflet, a copy of which may be obtained by addressing the Editor, Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York, if one is not accessible. The articles in that leaflet deal with the following subjects:

1. Setting the table and serving food
2. Washing dishes
3. The noon luncheon
4. Directions for canning and jelly making
5. Yeast and bread making

It is probable that these subjects are of even more importance this year than they were last, owing to the interest that we all feel in the conserving and preserving of food. A large number of schools have established the regular practice of having some form of warm noon luncheon during the winter months, and there are few things that are more worth while both because of its teaching power and because of the effect that the warm meal has on the children physically. In this connection a number of teachers have written regarding their experiences. One of the most interesting and suggestive letters follows:

I thought you would like to hear how we served warm lunches in school this winter. Some of the children have written you about it, but I am going to tell you more.

Last fall I had a mothers' meeting. All the mothers in the district came but one. We discussed various things. Then I asked them what they thought about warm lunches. They were interested. I spoke about an oil stove. One mother said that we could take hers "just as well as not." Another offered a teakettle, and others offered a basin, kettles, and other equipment.

The next Monday I talked to the children about it. Each child brought a plate, a cup, a knife, a fork, and a spoon. We did not buy anything but the kerosene. The district furnished that.

We commenced to serve one thing hot for the noon lunch the last of November and we have ever since. We have served the following: mashed potato, baked potato, scalloped potato, cocoa, beef soup, bean soup, tapioca pudding, and this spring some dishes with eggs in them. We had cocoa, bean soup, and mashed potatoes one day every week, and the other two days were optional.

There were several girls in school, and they had their special day for getting dinner. I helped some before school and at the forenoon recess. The boys have helped to get the dinner several times, and they often help serve it. The children sit at their own desks to eat. After eating, two or three pick up and wash the dishes.

Our superintendent knew about our hot lunches, and sent my name to the Household Products Distributing Company. Every little while we have some samples sent to us to try. The children enjoy that. The samples are full-sized packages and sometimes more than one of a kind is sent, so that we have enough for all the school. We have had one lesson in cake making. We made the cake and then ate it.

The children have enjoyed their lunches very much. It has taken them longer to eat. Each sits until we are all nearly through. Each child asks the one that prepared the dinner to be excused.

If we are going to have potatoes each child brings potatoes, and we take turns in bringing milk, beans, and the like. I furnish the cocoa. One day one mother sent us beef soup all ready to heat. The mothers have always sent what I asked them to. One father said that he was glad to have his children have something warm. There have been fourteen to eat every day and real stormy days eighteen. This plan has worked well in this school, and the children have all enjoyed it very much, and I think it is better for their health. I know that it has taken them longer to eat, and they have eaten more plain food. They have enjoyed it so well that I do not believe they will want to give it up when warm weather comes. I know it would not work so well in all schools, but in this one I had the cooperation of all the mothers. It has made me more work because I have had to oversee everything, but I feel well paid for all the extra work.

There are other phases of the home making work aside from those in cooking and in sewing and the things that relate to them. One of the most important subjects is sanitation and personal hygiene. They relate very closely to medical inspection and physical training and it is most encouraging to have the reports that are coming in constantly increasing numbers of systematic efforts to help boys and girls to take care of themselves particularly in matters of bathing, cleaning the teeth and the finger nails, sleeping with open windows, and the like. The consideration of such things by the school cannot help but make its influence felt in the homes of the district, and thus the wholesome influence will spread. (See page 265.)

There is the question of household decoration, which is most fascinating, and, when we come to think about it, one that exerts a very real influence on our lives. The schoolroom can be made a basis for beginning such work, and, after the first essential of cleanliness has been attained, the matter of attractiveness can be taken up. Standards of what is best in color combinations and design, arrangements of furnishings, and appreciation of quality, can be built up even with very young children. Everything with which we are associated teaches us, and there is little need to call attention to many of these things pointedly. Simply by working out a tasteful, homelike, attractive schoolroom, the teacher will be exerting an influence that will make itself felt.

In elementary schools it would seem best to have both boys and girls participate, as far as their inclinations dictate, in all phases of nature study, including natural history, agriculture, and home making. The chief consideration, after all, is not the technical knowledge that they will gain so much as it is the development that comes to them most readily from association with familiar things. Naturally, however, the boy who grows to manhood with an appreciation of the principles and practices involved in the care of the home, will have a background that will enable him to look on his own home with a greater degree of intelligence and

sympathy, just as the girl who has knowledge of farm and business practices will take a sympathetic and intelligent attitude toward those things when she grows to womanhood.

Teachers should be guided in the work in home making, as in all the other work that relates to the environment, by the natural opportunities that arise, and by the suggestions and inclinations of the children themselves. Unlike some of the phases of the nature study work, practically all of the work in home making can be applied to any season of the year, and there is no one best time to begin to consider cooking, or sewing, or sanitation, or decoration, or any other line of study, except the time when a question regarding them has come up naturally. Thus the fact that the technical material in this leaflet is confined for this year solely to sewing is not in any sense to be taken as indicating that the work in home making should be confined to sewing during the year 1917–1918. Some schools will be ready for the work in sewing; others will be more ready for some different phase of the work. It takes time to present all the material, but gradually it can be supplied, and teachers should meantime avail themselves of such books as it is possible to obtain for the school library (pages 252 and 318) and of various publications from the different state and national institutions. In this connection attention is again called to some of the Reading Course Lessons for the Farm Home, issued by the Department of Home Economics, College of Agriculture, Ithaca, New York, which can be obtained by sending to that Department. The numbers and titles of these are as follows:

NUMBER OF LESSON	TITLE
11	The laundry
23	Rules for cleaning
27	Choice and care of utensils
39	The farmhouse
41	Rules for planning the family dietary
43	The box luncheon
45	Hints on choosing textiles
49	Household insects and methods of control
85	The arrangement of household furnishings
103	Suggestions for the health of children
108	Planning the home kitchen
113	Food preservation: a national challenge

It should be clearly understood that the article on sewing, which immediately follows, aims to develop the fundamentals of the work, and to lay a basis on which future work may be given. In the case of the constructive problems no more has been given that the mere suggestion of the most desirable things to make and the processes that they involve.

HAND SEWING

Julia Gleason
Instructor in Home Economics

The fundamental processes of hand sewing considered in this article are the simple constructive and decorative hand stitches, seams, hems, garment fastenings, and the like. Methods of repairing clothing, such as darning and patching, are described. The few examples of the application of these processes are merely suggestive of the many useful and attractive articles that may be made.

EQUIPMENT

The equipment for hand sewing is simple, but good tools are necessary to obtain the best results.

A package of needles of assorted sizes, nos. 5 to 10, will be found convenient. White cotton thread, nos. 60 to 80 for general use and 100 to 120 for fine sewing, and blue cotton no. 50 for basting and practice stitches, are needed. Darning cotton or floss is a necessity, and crochet cotton, no. 60, 70, or 80, or mercerized embroidery floss in colors are used for the decorative stitches.

A thimble is worn on the middle finger of the right hand and should be large enough to let the finger fit well down into it, but not so large that it will slip off while working.

An emery bag is invaluable for keeping the needle smooth. A good tape measure, numbered "one" from each end, pincushion, and pins are used constantly. Sharp scissors mean accurate work. A table or a desk with a foot rest contributes much to the comfort of the worker.

CONSTRUCTIVE STITCHES

RUNNING STITCH

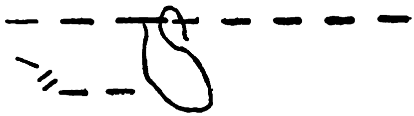
The running stitch is the most elementary as well as one of the most useful of the plain hand stitches. It is taken from right to left and consists of a straight line of stitches made by passing the needle over and under a certain number of threads of the material. There are many variations of the running stitch. They fall into two groups: temporary stitches and permanent stitches. The basting stitches form the first group, and the running, the gathering, the shirring, the gauging, the second group.

Temporary, or basting, stitches

Basting is used to hold material in place until it is firmly sewed. Basting may be begun with a knot and ended with several diagonal stitches

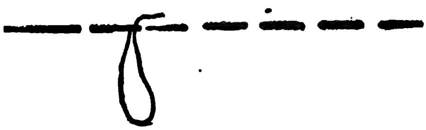
above the end of the basting or with two backstitches. There are four kinds of basting.

1. *Even basting.*— In even basting the overstitch and the understitch are the same length, usually one-fourth to one-half inch. It is used to hold seams, hems, and the like until they are firmly sewed.



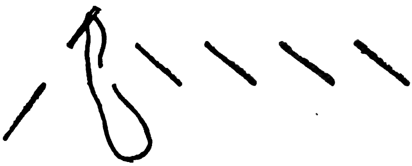
EVEN BASTING

2. *Guide basting.*— In guide basting the overstitch is long and the understitch short, usually one-half and one-eighth inch respectively. It is used when a guide is desired, the long stitch on top being easy to follow.



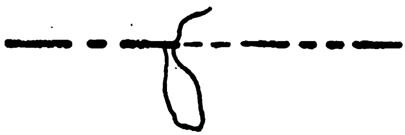
GUIDE BASTING

3. *Diagonal basting.*— In diagonal basting both the overstitch and the understitch slant; the overstitch is long, the understitch short. It is used to take the place of two rows of basting when adjusting interlinings, lace to be appliquéd, and the like.



DIAGONAL BASTING

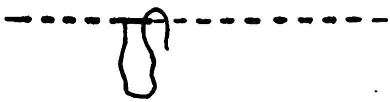
4. *Dressmakers' basting.*—In dressmakers' basting there is a long overstitch, two small even basting stitches, another long overstitch, and so on. This is a more secure stitch than the even or the guide basting and, in a measure, serves the purpose of both. It is seldom used in hand sewing.



DRESSMAKERS' BASTING

Permanent running stitches

Running stitch.— The running stitch is made like the even basting, but is very small as it is a permanent stitch and must be secure. Daintier results are obtained when it is begun without a knot, by taking two small stitches from left to right and sewing back over these and catching the end of the thread. It should be ended with several over-and-over stitches on the wrong side through one thickness of the material. The running stitch is simple in itself, but is tedious to make and difficult to keep even unless the proper running motion is used. The needle is placed in the material



RUNNING STITCH

about one-fourth inch from the edge; the edge of the material and the point of the needle are held between the forefinger and the thumb of the

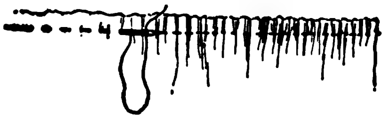
RUNNING STITCH SHOWING POSITION OF WORK

right hand, and the thimble finger is placed on the head of the needle. The material is moved back and forth with the left hand as the thimble

RUNNING STITCH SHOWING NEEDLE IN CLOTH

finger pushes the needle through. The length of the stitch is regulated by the rapidity with which the material is moved back and forth with

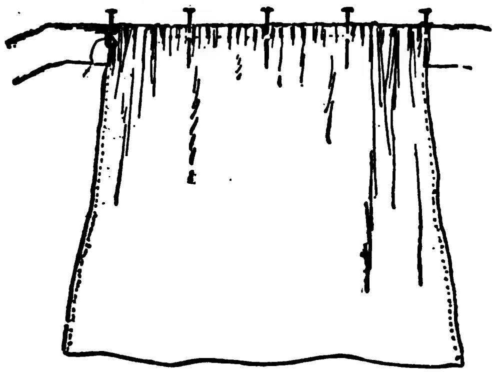
the left hand and the pressure on the needle by the thimble finger. The needle is left in the material and, as the work progresses, it is pulled off the eye of the needle. The running stitch is used for seams and the like.



GATHERING STITCH

Gathering stitch.— The gathering stitch is a small even running stitch made with the running motion. It is begun with a knot and usually finished by leaving a knotted end of thread, which may be drawn up and wound around a pin when adjusting the gathers. Gathering is used when fullness is to be set into a band as in an apron or a petticoat, for ruffles, and the like.

To adjust gathers: Divide the part to be gathered and the band into which it is to be set, into equal parts — halves, quarters, eighths, according to the length of the band. Mark these divisions with several running stitches or a cross-stitch. Pin the gathered material to the band, matching the markings, and adjust the fullness between these points.



GATHERS ADJUSTED TO BAND

To stroke the gathers: The gathers will lie more flat and smooth if stroked or pulled. Draw the thread up until the gathers lie very close together, hold the gathered material in the left hand, and with the point of a blunt needle or the eye of an ordinary needle, beginning at the end of the gathering, push the fold made by each gathering stitch between the forefinger and the thumb of the left hand and crease it into place.

GATHERS STROKED (LEFT) AND UNSTROKED (RIGHT)

The gathers may be pulled into place a little less accurately by holding the gathers tightly between the forefinger and the thumb of the left hand and pulling the material over the finger with the right hand in such a way as to crease the pleats into place.

STROKING GATHERS

Shirring.—Shirring consists of several rows of gathering at various distances apart. It is used for ornamentation and holds the gathers in place more firmly than a single row. (See page 220.)

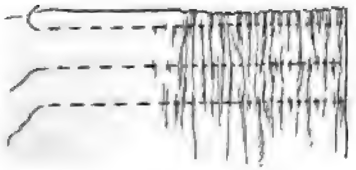
Gauging.— Gauging consists of a long overstitch and a short understitch. Several rows are made, each stitch of each row lying directly under the one above. It is used when a large amount of material is to be gathered into a small space, for example, the very full skirt of a child's dress. (See page 220.)

PULLING GATHERS

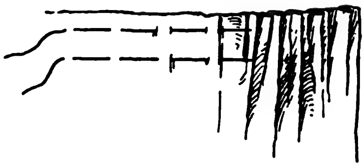
BACKSTITCH

The backstitch has the appearance of the running stitch on the right side, but is made in a different way. It is very much stronger than the running stitch. It is begun like the running, but one stitch is made at a time. The first understitch

is made twice the length desired, and the second stitch is begun halfway back on this space and ended twice the length of the stitch ahead. Each succeeding stitch is made in the same way. It is ended like the running stitch. The backstitch is sometimes called the halfback stitch. It is used on seams that must be strong enough to withstand a strain.



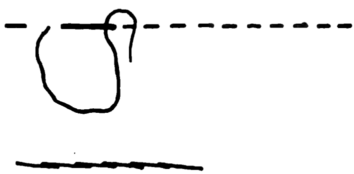
SHIRRING



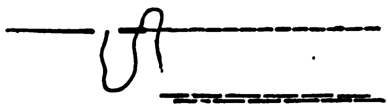
GAUGING

STITCHING STITCH

The stitching stitch is so called because it looks like the stitching made on the sewing machine. It is begun like the running, but one stitch is made at a time. The first stitch is made the length desired. The second stitch is taken back over this space by placing the needle in the material at the beginning of the first stitch and bringing it out the length of the stitch ahead of the end of the first stitch. Each succeeding stitch is taken back over the space thus made and is ended the length of a stitch ahead, making one continuous line of stitches. It is ended like the running stitch. The stitching stitch is sometimes called the backstitch. It is the strongest of the seam stitches.



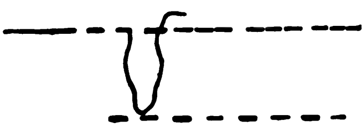
BACKSTITCH, RIGHT AND WRONG SIDES



STITCHING STITCH, RIGHT AND WRONG SIDES

COMBINATION STITCH

The combination stitch is a combination of running stitches and backstitches. It may be made in various ways. The one most used consists of two running stitches and a backstitch. The right side shows groups of three stitches, the center one of which is a backstitch. The wrong side shows even stitches and spaces, every other stitch being double.



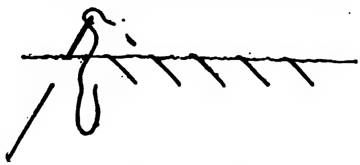
COMBINATION STITCH, RIGHT AND WRONG SIDES

This stitch is stronger than the running stitch, but not so strong as the backstitch or the stitching stitch. It is more quickly made than the

latter and is often used for the second stitching of the french seam, the first stitching of the fell, and the like.

OVERCASTING

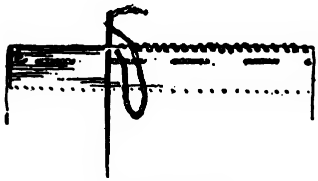
Overcasting is a loose, diagonal stitch, usually taken one-eighth inch deep and the stitches one-fourth inch apart. It is taken over raw edges to prevent raveling. It is taken from right to left and may be begun with a knot or with several running stitches from left to right, and ended with several small backstitches. In order to join the stitch, it should be ended with the running stitches and the new thread begun in the same manner, as inconspicuously as possible. This stitch is particularly useful as a finish for seam edges.



OVERCASTING

OVERHANDING

Overhanding is a very small over-and-over stitch taken to hold two finished edges together. Two folded edges, lace edges, or selvages are basted together; the stitch is taken from right to left. It is begun without a knot by taking the first stitch in the edge toward the worker and leaving the end of the thread, which is sewed over and held in as the work proceeds. The needle is pointed toward the worker, making a straight stitch on the right side. The stitches should be very fine and very close together, but they should not be drawn too tight or crowded. In order to join the stitch, the end of the old thread through the end farther away from the worker should be left, and the new thread begun as the stitch was begun, sewing over both ends. Overhanding is ended with several over-and-over stitches in the same place or by overhanding back over several stitches. This stitch is used for piecing, patching, hemming table linen, joining laces, and similar work. It is sometimes made on the right side, for example when overhanding the ends of bands, and the like.



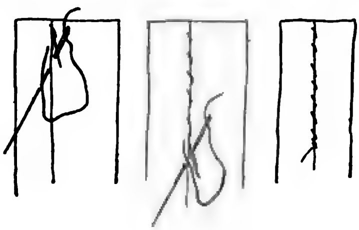
OVERHANDING

HEMMING

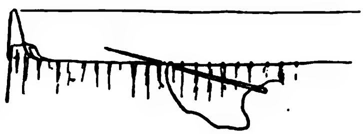
The hem is a finish for the raw edges of garments and household articles, such as skirts, handkerchiefs, towels, table linen, and the like. It is used for strength and for decoration. The hem consists of two turnings, the first one just wide enough to keep the edge from raveling, the second any width desired. The folded edge is basted into place and finished by machine stitching, a decorative stitch (page 225), or the hemming stitch.

Plain hemming stitch

The plain hemming stitch is a slanting stitch on both the right and the wrong side of the material. The work is held in a vertical position over the left forefinger with the hem at the left. The stitching is begun without a knot by taking the first stitch through the folded edge and concealing the end of the thread within the hem as the work proceeds. The stitch is taken through a few threads of the cloth directly under the edge of the hem, then into the fold of the hem, pointing the needle over the left shoulder. The needle is pointed in the same direction each time in order to make the stitches slant evenly on the right side. Each succeeding stitch is taken slightly in advance of the one before in order to make the stitch slant evenly on the wrong side. In order to join the stitch, the old thread is ended with the stitch in the cloth and the new thread begun with a stitch in the fold. Both ends are concealed within the hem and secured as the work proceeds. The hemming stitch is ended with several over-and-over stitches or several running stitches in the fold of the hem. The hemming stitch is used to secure folded or finished edges, such as hems, facings, fells, lace, and the like.



PLAIN HEMMING



VERTICAL HEMMING

Vertical hemming

Vertical hemming is used when hemming gathers to a plain edge as in the last sewing of a band (page 233). It is made by taking a straight stitch on the side toward the worker and a slanting stitch on the side away from the worker. The work is held as in the plain hemming, and the stitch is begun in the same way. Each stitch is taken exactly opposite the point where the preceding stitch ended, thus making a straight stitch on the side toward the worker. The stitch is taken through one thickness of material only, and is invisible on the right side of the garment.

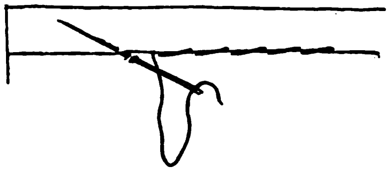
Damask hemming

Damask, french, or napery hemming is discussed on page 230.

Blind hemming

Blind hemming is made by taking a very small hemming stitch in the threads of the cloth and through the folded edge of the hem. This makes

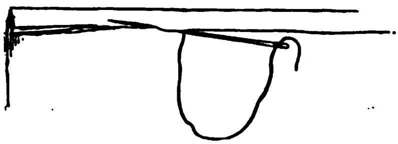
an invisible stitch on the right side and a longer stitch on the wrong side than in plain hemming. This stitch is used when an invisible finish is desired in the hems in wools, silks, and the like.



BLIND HEMMING

Slip stitching

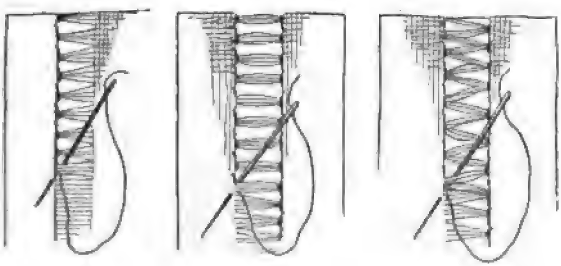
Slip stitching, or blind stitching, is made by taking a stitch usually about one-fourth inch long in the fold of the hem, then a small stitch in the cloth directly under the fold of the hem, which may or may not be made invisible on the underside as desired. Two folded edges may be slip stitched together by taking a one-fourth inch stitch first in one fold then in the other.



SLIP STITCHING

Hemstitching

Hemstitching is an elaboration of the hemming stitch, and is used for ornamentation as well as for securing the edge of the hem. Threads are drawn in the material beginning at a distance from the edge equal to the width of the first turning plus twice the width of the second turning from the edge, and the folded edge of the hem is basted to the lower edge of the space thus formed. The work is held in a vertical position, and the first stitch is taken as in plain hemming. The second stitch is taken under a group of threads only (the number dependent on the fineness of the work desired), and the third is taken back under the same group (but not through the material) and through the fold of the hem so as to bind the threads together and secure the edge of the hem. This stitch is joined and ended as for plain hemming. Hemstitching is used as a dainty finish and a decoration on waists, infants' garments, and the like.



VARIOUS TYPES OF HEMSTITCHING

A, hemstitching; B, double hemstitching; C, diagonal hemstitching

Double hemstitching

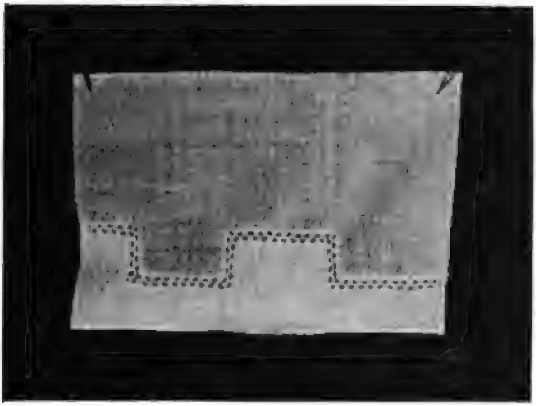
Double hemstitching is made by repeating the hemstitching on the opposite side of the drawn space, taking the same groups of threads, thus making straight bars across the open space.

Diagonal hemstitching

Diagonal hemstitching is made by repeating the hemstitching on the opposite side of the drawn space, taking half of the two groups of threads for each stitch, thus making diagonal bars of threads across the open space.

Bermuda fagoting

Bermuda fagoting is also an attractive way to secure a hem. It may be made to follow any design, as the threads do not have to be drawn in preparation for the work. It may be used to sew lace flat to material. Bermuda fagoting has somewhat the appearance of hemstitching. A very large crewel needle or a carpet needle is used with fine thread (120 to 150). The thread is tied in the eye of the needle. The work proceeds toward the worker. The first stitch is taken diagonally from right to left, and the end of the thread is tied in the stitch. The second stitch is taken straight toward the worker, beginning in the first hole made by the first stitch, and the threads are bound together by two more stitches taken in the same holes. Then the second and the third holes are bound together by two stitches, and the third stitch is taken toward the worker, beginning in the second hole made by the first stitch, the second and the fourth holes are bound together, the third and the fourth, and so on.



BERMUDA FAGOTING

Whipping

Whipping is the term usually applied to overhanding when used to sew laces together or to a garment.

Rolling and whipping

Rolling and whipping is the process of sewing lace or beading to a rolled hem (page 230). The stitch is taken over the roll and through the lace at the same time.

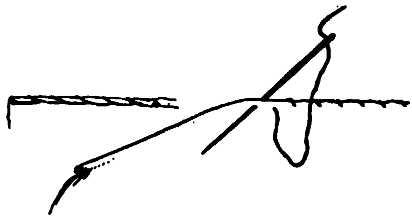
Whipping over raw edges

Lace or beading may be sewed to material by holding or basting it about one-eighth inch from the raw edge and whipping over the edge and through

the lace, letting the thread draw the material down so that it has somewhat the appearance of rolling and whipping. Stitches are taken close together and drawn tight. Two raw edges of material may be whipped together in this way. This method is not quite so neat as rolling and whipping, but is more quickly and easily done.

APPLIQUÉING LACE

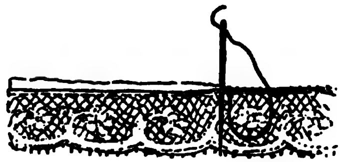
Lace edge or insertion is basted flat on the material in the design desired. The edges are sewed down with the hemming stitch. The material under the lace is cut away one-eighth inch from the hemming stitches, and this one-eighth inch is creased back and whipped down to the edge of the lace. Whipping stitches should not go through to the right side.



ROLLING AND WHIPPING

SIMPLE DECORATIVE OR EMBROIDERY STITCHES

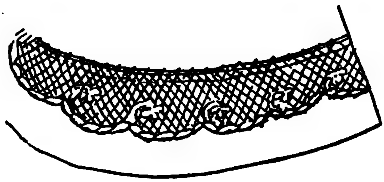
The decorative or embroidery stitches are described in their simplest, most fundamental forms. Many attractive designs simple or elaborate, may be made by modifying and combining those given in various ways.



WHIPPING OVER RAW EDGES

RUNNING STITCH

The running stitch described may be made in various combinations and varieties of material for decoration.



APPLIQUÉING LACE, WRONG SIDE

OUTLINE STITCH

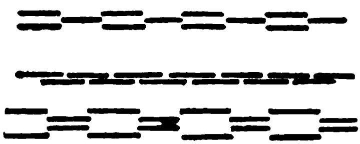
The outline stitch is worked from left to right. The length of the stitch is determined by the material used and the effect desired. It is usually one-eighth to one-fourth inch. The needle is put into the material the desired length of the stitch to the right of the starting point and brought out exactly beside the starting point. The second stitch is begun the same distance in advance of the first stitch and the needle brought out exactly beside the end of the first stitch, and so on. The thread is kept to the left of the needle toward the outside of the design. The outline stitch is used to outline designs of various kinds. It may be done in silk, cotton, or wool yarns.

COUCHING

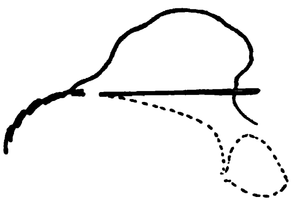
Couching is usually made with two kinds of thread. A cord, heavy floss, or several strands of thread, are laid along the design and sewed to the cloth by taking a small stitch with finer thread across the cord at regular intervals. Couching is used to outline conventional designs.

CHAINSTITCH

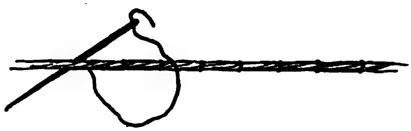
The chainstitch varies in appearance according to the material and the length of the stitch used. It is taken toward the worker. The stitch may be begun by taking several running stitches away from the worker through one thickness of material and bringing the thread through to the right side. For the first stitch the needle is put into the material back at the starting point and brought out the length of the stitch ahead, usually one-eighth to one-fourth inch. The thread is thrown under the point of the needle from left to right so as to form a loop as the needle is drawn through. The second stitch is made by placing the needle in the material where it was brought through for the first stitch — within the loop — and the work proceeds as described for the first stitch. To end the chainstitch the needle is placed in the material *outside* of the loop and drawn through to the wrong side where it is fastened with several running stitches through one thickness of material. The chainstitch is used as an outline for designs, to secure hems, tucks, and the like.



DECORATIVE RUNNING STITCH



OUTLINE STITCH



COUCHING

LAZY DAISY

The lazy daisy is made by placing chainstitches in the position of the petals of a flower. The work is begun a short distance from the center point of the flower, and four or five chainstitches are taken radiating around the center. The lazy daisy is attractive used in combination with the chainstitch as a decoration for underwear or for infants' garments.

BLANKET STITCH

The blanket stitch is an edge finish. It is begun with several small running stitches taken at right angles to the edge of the material, bringing

the needle out as near as possible to the edge. The work proceeds from left to right. For the first stitch the needle is placed in the material a short distance from the edge, one-eighth to one-half inch according to the materials. The thread is thrown under the point of the needle from left to right and the needle drawn through toward the worker. Each succeeding stitch is taken in the same way, the distance desired to the right of the stitch before and the same distance from the edge.

Attractive variations of this stitch may be made by changing the depth and the slant of the stitches and the distance between.

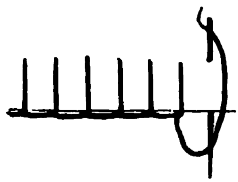

CHAINSTITCH

SCALLOPING STITCH

The scalloping stitch is made in the same way as the blanket stitch. The stitches are taken as close together as possible, usually in a scalloped design, and the material is cut away around the edge of the design afterward. The scallops may be padded with the running, the outline, or the chainstitch. To make the edge stronger and more secure, the buttonhole stitch (page 240) may be taken just over the edge after the material has been cut away.


LAZY DAISY

The scalloping stitch is used to finish the edges of linens, underwear, and the like.


BLANKET STITCH

FEATHERSTITCH, OR BRIAR STITCH

The featherstitch, or briar stitch, is a series of blanket stitches taken on either side of an imaginary line, making a stitch with a vinelike appearance. It proceeds toward the worker. Practice is required to keep the stitches and the spaces even and regular. There are many variations of the featherstitch in the number of stitches taken on each side of the vine and in the direction in which these stitches are taken. The featherstitch is used to secure hems, tucks, and the like, and as a decoration for underwear, infants' garments, collars, and similar articles.


VARIATIONS OF BLANKET STITCH

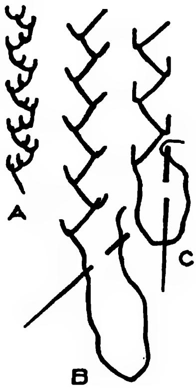

SCALLOPING STITCH

CORAL STITCH

The coral stitch is a variation of the featherstitch. The stitches are taken straight toward the worker, and have the vertical formation of coral.

HERRINGBONE, OR CATCH, STITCH

The herringbone, or catch, stitch is made from left to right between two imaginary horizontal lines. The needle is brought through at the left end of the upper line, and the first stitch is taken from right to left on the lower line far enough to the right of the starting point to make the resulting stitch slant. The next stitch is taken in the same manner on the upper line, making the threads cross and slant in such a way that the stitch taken on one line is opposite the space between the stitches on the other line. This stitch is used as a decoration and for securing the raw edges of seams, hems, and the like, in flannel and in some other materials.

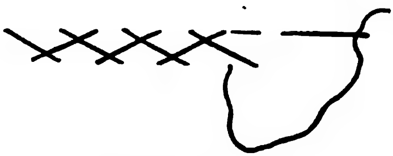


FEATHERSTITCH

A, double; B, single; C, coral

CROSS-STITCH

Each cross-stitch consists of two stitches that cross each other, forming the diagonals of a square. The designs for cross-stitch consist of a series of squares that are filled in with diagonal stitches. For this reason the work has a quaint, angular appearance, which is part of its charm. The work may be done by following the weave of certain materials, such as regularly spaced cross-barred dimity, huckaback, and the like, or by working over cross-stitch canvas which may be drawn out when the work is finished. Care should be taken to cross the stitches the same way each time. The cross-stitch is used for initials, for marking linens, and for various designs on garments and household articles. The designs or the background may be worked in cross-stitch.


HERRINGBONE STITCH

FRENCH KNOTS

French knots are made by drawing the thread through to the right side at the starting point, winding the thread close to the material around the point of the needle several times, placing the needle in the material very near the starting point, and drawing it to the wrong side through the coil of thread which is held down with the left thumb. French knots are used to secure hems, to outline designs, or to fill in spaces, such as flower centers and the like.

CONSTRUCTIVE PROCESSES

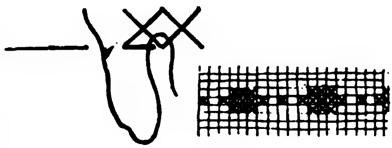
Many of these constructive processes are used in machine as well as hand sewing. The hand method only is discussed here.

SEAMS

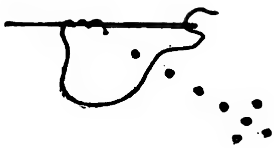
The seam is used to join two edges of material.

Plain seam

The plain seam is made by placing together the two right sides of the pieces to be joined, with the edges even, basting and sewing the desired distance from the edges with the running, the backstitch, the stitching, or the combination stitch. The raw edges may be overcast, together or separately. This seam is seldom used in hand sewing, as dainty work and fine materials demand a neater finish. It is used as a foundation for most of the other seams, however.



CROSS-STITCH



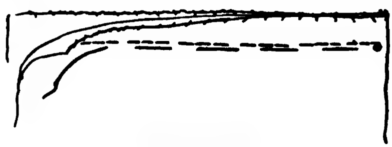
FRENCH KNOTS

French seam

The french seam is made by sewing a plain seam on the right side of the garment with the running stitch, trimming the edge usually one-eighth inch from the seam line, creasing the seam out sharply, and turning it so that the two right sides are together. The seam is then basted and sewed a second time usually with the combination stitch, making the finished seam just wide enough to enclose the raw edges of the first seam. The french seam is sometimes called the double seam. The french seam is a neat, strong, and inconspicuous seam and is used on undergarments, dresses of light weight materials, infants' garments, and similar articles.

The fell, or felled seam

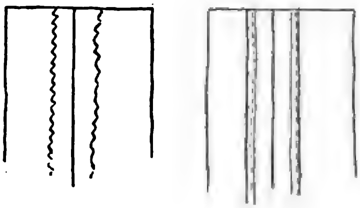
Hemmed fell.— The hemmed fell is made by sewing a plain seam on the wrong side of the garment with the running, the combination, the backstitch, or the stitching stitch, according to the strength desired. The under edge of the seam is trimmed to one-eighth inch, the wider edge is turned over the narrow one, and the seam basted flat to the material. The folded edge is sewed down to the material with the hemming stitch. The hemmed fell is smooth and flat and is used on undergarments, infants' garments, and in places where the smoothest finish possible is desired.



PLAIN SEAM

Overhanded, or french, fell.— In the overhanded, or french, fell, overhanding is used for the second stitching. The material is creased back

on a line with the folded edge of the fell, and the two folded edges overhanded as in french, or damask, hemming. Some materials are more easily hemmed in this way.

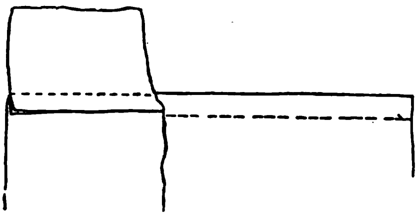


PLAIN SEAMS
Pinked seam (left) and bound seam (right)

Flannel fell.— In the flannel fell the edges of the seam are left raw instead of turning the wider edge over the narrower as in the other fells. Catch stitching is used to secure this raw edge flat to the material. The flannel fell is used in flannel petticoats, baby blankets, and the like.

HEMS

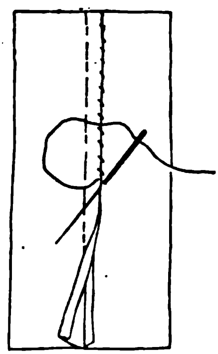
Plain hem



FRENCH SEAM

The plain hem may be varied in many ways when used for ornamentation. It may be finished by a single line of chainstitching, featherstitching, or hemstitching, or elaborations of these.

Shaped hem

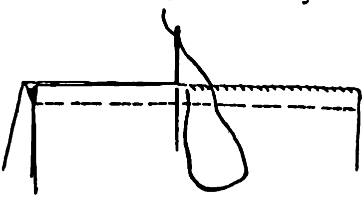


HEMMED FELL

The hem may be turned once and finished with a decorative stitch in a simple design, such as the wall of troy or the scallop, and the material trimmed close to the stitch on the wrong side. It is not necessary to turn the under edge before applying the decorative stitch if the stitch is strong enough to be secure and prevent the material from fraying.

French, damask, or napery hem

The french, damask, or napery hem is narrow, usually one-eighth inch, and is used chiefly on table linen. The hem is turned to the wrong side, then creased back on the right side, and the two folds are sewed with fine overhanding stitches. When the work is completed, the hem is pressed out flat.

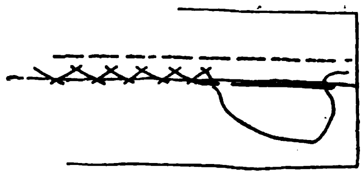


OVERHANDED, OR FRENCH, FELL

Rolled hem

The rolled hem is a very dainty finish for the edges of collars and cuffs, handkerchiefs, and the like. Made with colored thread or floss it may

also serve as a decoration. The right side of the material is held toward the worker, and the edge rolled toward the wrong side between the forefinger and the thumb of the left hand. The stitch may be begun by concealing a small knot under the roll or by sewing over the end of the thread as in overhanding. It is taken from right to left *over* the roll, not through it.



FLANNEL FELL

Ruffles may be gathered in this way by drawing up the thread as the work proceeds. This makes a very satisfactory edge to which to sew beading, lace edge, and the like. It is used on infants' garments, fine undergarments, handmade waists, and similar articles.

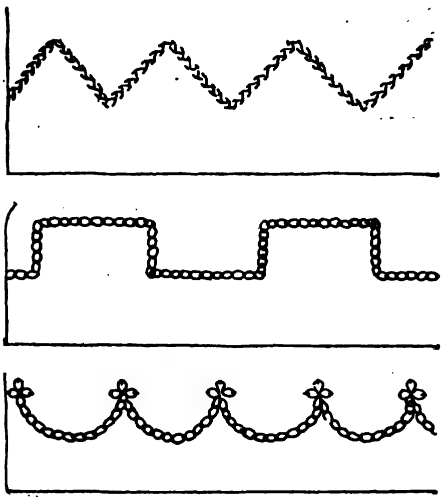
FACINGS

Facings may be used instead of hems.

The facing is cut, any width desired, usually with the grain of the material running the same way as the piece to be faced. The article and the facing are sewed together in a seam on the wrong side. The facing is then creased up sharply to the wrong side on the seam line, and the other edge is finished like a hem.

Shaped facings

A shaped facing may be made by sewing the seam in a simple design, such as scallops or points, trimming it to one-eighth inch, turning it to the wrong side, and finishing the facing like a hem. This edge may be featherstitched or crocheted. Shaped hems and facings make very attractive finishes for ruffles on undergarments, infants' garments, collars and cuffs, and the like.



SHAPED HEMS

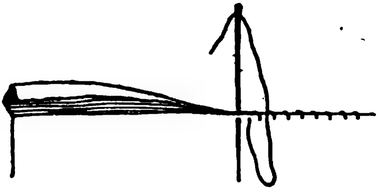
CORNERS

When hemming an article, such as a luncheon cloth or a handkerchief, one of two methods of turning the corners is commonly used.

Square corners

The hem is turned on two opposite sides, then on the remaining two. In order to avoid clumsiness at the corners the material is cut out under-

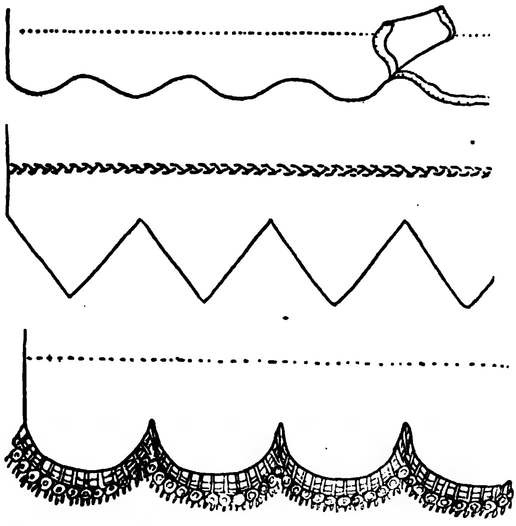
neath leaving just enough for narrow turning. The ends are overhanded or slip stitched. Hemming stitches across the hem at the end are taken through one thickness only so that they do not show on the right side. (See illustration.)



NAPERY, OR DAMASK, HEMMING

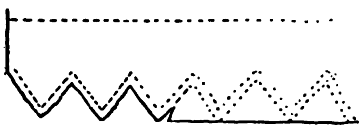
Mitered corners

The hems on the two adjacent sides meet in a diagonal seam that exactly bisects the corner. To avoid clumsiness, the superfluous material is removed by cutting diagonally across the corner, leaving just enough material for a narrow turning (see illustration). Care must be taken to cut at points equally distant from the corner. The mitered corner may be sewed in a seam on the wrong side and turned right side out, or it may be hemmed, taking care not to take stitches through to the right side.



SHAPED FACINGS

The miter is also used when sewing lace or other trimming around corners. There are two kinds of corners to be considered, the inside corner and the outside corner. When sewing lace around the inside corner, no extra fullness is allowed as the corner is turned. A diagonal seam is then made in the lace exactly bisecting the corner. Care should be taken to match the pattern in the lace. To finish on the wrong side, the fold of lace may be laid flat and hemmed down, or cut and finished with the hemmed fell, or rolled and whipped. When sewing lace around the outside corner, twice the width of the lace is allowed at the corner in order to provide sufficient fullness at the edge; a diagonal seam is made in the lace exactly bisecting the corner and finished on the wrong side as for the inside corner.

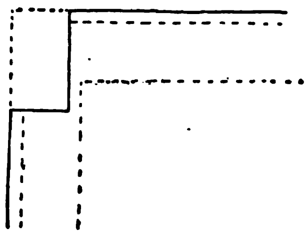


FIRST SEAM OF POINTED FACING
STITCHED AND CUT

BANDS

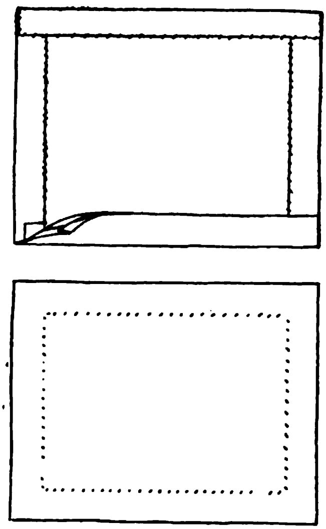
Straight band

The straight band is used to finish the waistline of undergarments, aprons, bottoms of sleeves, and the like. It is cut lengthwise of the material, as the lengthwise threads are stronger than those running crosswise and bands usually have to withstand considerable strain.



CUTTING SQUARE CORNERS

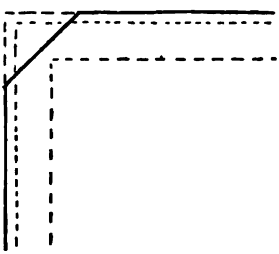
The right side of the band is placed to the right side of the garment to which it is to be applied, the gathers in the garment (if any) are adjusted (page 218), and a seam, usually one-fourth inch wide, is basted and sewed with the combination, the backstitch, or the stitching stitch, exactly on the line of the gathering. The work is held with the gathered material toward the worker.



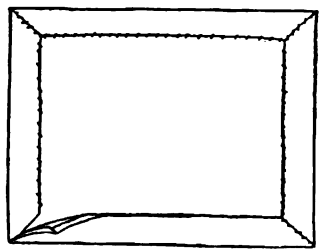
SQUARE CORNER: WRONG SIDE (ABOVE), RIGHT SIDE (BELOW)

The band is then creased up sharply from the garment, the ends turned in the desired width, and the other edge turned in the width of the seam and brought over the seam so that the folded edge just covers the stitching.

Great care should be taken to keep the grain of the material straight and not to pucker or stretch the edge of the band as it is basted into place and sewed down with the vertical hemming stitch. This stitch is taken through one thickness only and should not show on the right side. The ends of the band are usually turned in and overhanded.



CUTTING MITERED CORNER

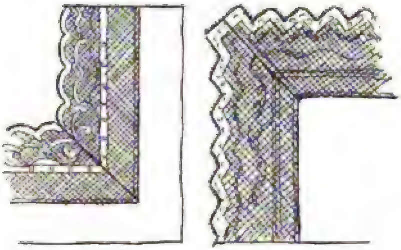


MITERED CORNER, WRONG SIDE

BINDINGS

Binding is used to finish such edges as those of seams and plack-

ets. It may be made like the band and applied in the same way, or a binding ribbon or tape, finished on each edge, may be used. The binding ribbon is creased in the center and slipped over the edge to be bound and finished with one stitching.

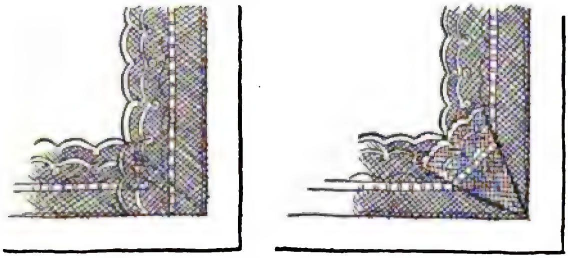


USE OF MITER IN SEWING LACE AROUND INSIDE CORNER (LEFT) AND AROUND OUTSIDE CORNER (RIGHT)

Bias bands, facings, and bindings

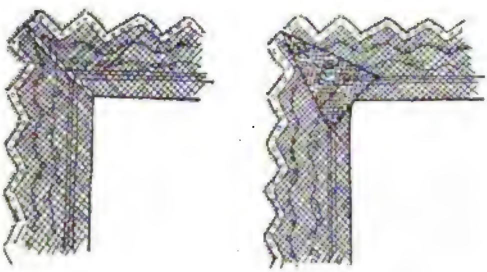
Bias bands, facings, and bindings are used for decoration, and for finishing curved edges, seams, binding in sleeves, and the like.

Garment bias.— Garment bias is any straight line that does not run exactly with the lengthwise or the crosswise thread of the material. The edges of the gores of skirts are usually cut on the garment bias.



TWO METHODS OF FINISHING MITER (INSIDE CORNERS, WRONG SIDE)

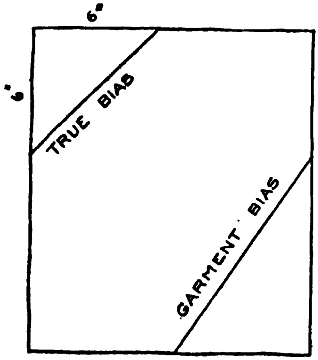
True bias.—True bias is a straight line that crosses the warp and the woof (lengthwise and crosswise threads) exactly where they intersect. This line is the diagonal of a perfect square. It is cut by folding the material so that the woof threads lie parallel to the warp threads and cutting on the folded line thus found; or by placing points on the warp and the woof equidistant from the corner of the material and cutting from one to the other in a straight line.

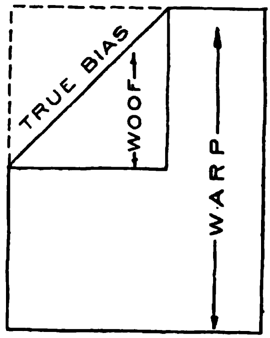


TWO METHODS OF FINISHING MITER (OUTSIDE CORNERS, WRONG SIDE)

All bias facings, bands, bindings, and the like are cut on the true bias because a true bias strip stretches evenly throughout its entire length and may be easily adjusted to curves. Great care should be exercised in cutting several strips to keep the edges on the true bias.

To join bias pieces.— Bias pieces are joined on the straight of the material. The ends are cut diagonally, with the thread. The pieces are placed together with the straight edges even and the bias edges at right angles to each other so that the seam will be on the straight of the





material and the pieces joined in a straight line. The bias edges of the two pieces should come together at the seam line, *not* at the seam edge, in order to make the joining even.

PLACKETS

The placket is the opening in such garments as petticoats, drawers, dresses, and the like. It is usually from nine to twelve inches in length.

Hemmed placket

The hemmed placket may be used in children's dresses and in infants' garments when the opening of the garment is on the straight of the material. It is a dainty, neat finish, but not very strong. It may be made in two ways.

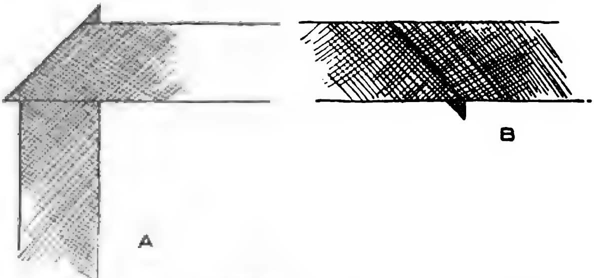
1. Each side of the opening is hemmed with a narrow hem, one-eighth to one-fourth inch at the top and slanting off to nothing at the base of the opening. The right-hand side of the placket is then creased back to the wrong side one-half inch from the edge and folded over the hem on the left side, making a pleat at the bottom which is sewed securely in a rectangle, a triangle, or a slanting line with the backstitch or the stitching stitch.

2. The left side of the opening is hemmed with a narrow hem, one-eighth to one-fourth inch at the top and running off to nothing at the base of the opening. The right side is hemmed with a one-half-inch hem and folded over the left side, making a pleat at the bottom which is finished as in the first case.

Bound placket

The bound placket is a strong, invisible placket, easily and quickly made. It is used on undergarments, children's dresses, and the like.

A strip is cut lengthwise of the material, a little more than twice the depth of the opening and as wide as desired, usually three-fourths inch wide finished. The right side of the strip is placed to the right side of the material and sewed in a one-fourth-inch seam, being careful at the base to run out to nothing if there is no seam in the garment and to make the stitching a continuation of the seam line if there is a seam.



JOINING BIAS PIECES
A, strips in position for seam; B, right side of finished joining

The strip is creased out sharply from the seam, the other edge is turned in the width of the seam and folded over the seam so that the folded edge just covers the stitching. It is finished with the hemming stitch taken through one thickness so that the stitches do not show on the right side. The binding on the right side is turned back on the seam line when the placket is closed. The base of the placket is finished by backstitching securely in a slanting line to prevent the binding from turning out at the bottom of the opening.

Continuous bound and faced placket

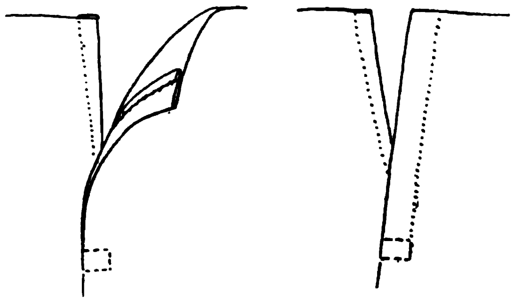
The continuous bound and faced placket is strong and neat and is used when fastenings, buttons and buttonholes, are desired in a placket, for example in the drawers of a combination suit.

The work proceeds as for the bound placket through the sewing of the first seam. The strip is then creased in the center throughout its entire length, and horizontally at the base of the opening. On the right-hand side of the opening, which is to be faced, a strip is cut lengthwise on a line one-fourth inch beyond the center crease to a point within one-fourth inch of the horizontal crease. It is then cut horizontally to the same point, removing the superfluous material. The facing is then creased back sharply to the wrong side on the seam line, basted into place, and hemmed. The binding on the left side is finished as in the bound placket, and the same finish is used at the base. The placket may also be stitched horizontally at the base for a more secure finish.

Continuous bound and faced placket with fly

The continuous bound and faced placket with fly is used in such undergarments as petticoats, where the fastenings are desired to be invisible.

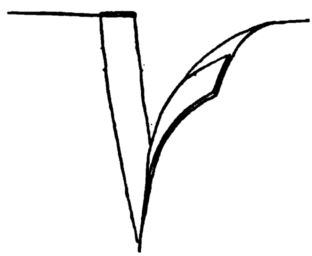
For a placket binding three-fourths inch wide when finished, a lengthwise strip is cut two and one-half inches wide and a little more than twice the placket depth. The work proceeds as for the bound placket through the sewing of the first seam. The strip is then creased three-fourths inch from the seam line throughout its entire length and horizontally at the base of the opening. It is then cut on this horizontal crease to the three-fourths-inch crease.



TWO METHODS OF MAKING HEMMED PLACKET

On the left side a second crease is made three-fourths inch from the first crease and folded over the seam so that the folded edge just covers the stitching, basted into place, and hemmed. This makes three thicknesses of material in extension to provide a strong place for sewing on buttons or other fastenings.

On the right-hand side a second crease is made three-fourths inch from the first crease, but *turned to the right side*. The raw edge comes to the first crease. The folded strip is then creased to the wrong side on the seam line, basted flat so that the folded edge of the fly is even with the fold on the seam line, and stitched with the backstitch or the stitching stitch just far enough in to secure the raw edge, about one-eighth inch. The edges at the bottom are buttonholed together (buttonhole stitch, page 240). The base may be finished with a diagonal line of stitching. The fly may be overhanded or buttonholed to the facing between the buttonholes.



BOUND PLACKET

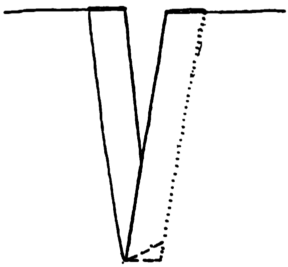
TO SEW ON TAPES

Tapes are sewed to such articles as towels, holders, and the like, for convenience in hanging them up. Two methods are commonly used.

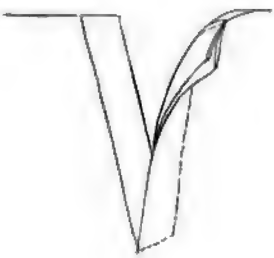
1. Cut the tape about four and one-half inches long. Fold it crosswise, letting one end extend one-quarter inch beyond the other. Fold this

longer end over the shorter one, and apply the tape to the article one-quarter inch from the edge so that the raw edge of the tape is between the tape and the material. Hem three sides to the article, crease the folded tape back, and overhand the edge of the article to the fold of the tape.

2. Cut the tape as for the first method, turn in both ends one-fourth inch, and apply it to the article with the folded ends side by side one-fourth inch from the edge of the article so that the raw edges of the tape are between the tape and the material. Hem the ends of the tape to the material around three sides, and overhand them together in the center. Crease the tape back, and overhand the edge of the article to the fold of the tape.



BOUND AND FACED PLACKET



CONTINUOUS BOUND AND FACED PLACKET WITH FLY

GARMENT FASTENINGS

Garments are usually fastened by means of buttonholes and buttons, hooks and eyes, or snap fasteners.

Buttonholes and buttons are the best method in most cases, both for strength and for decoration. They launder better than hooks and eyes or snaps; so they are generally used for wash garments. They often form an interesting part of the design of a garment.

Hooks and eyes, or snap fasteners are used for invisible finishes, such as the plackets of wool or silk dresses, skirts, and the like.

THE BUTTONHOLE

There are two types of buttonholes:

1. The single-bar buttonhole has a bar at one end and a fan at the other. It is usually placed horizontally in the garment, and is used where there is a strain so that the button rests in the end of the buttonhole, as in the back of waists, in cuffs, and in similar places.

2. The double-bar buttonhole has a bar at both ends. It is usually placed vertically in the garment and is used where there is little or no strain so that the button slides up and down in the buttonhole, as in the front of shirt waists, plackets of full skirts, sleeves, and in similar places.

To place buttonhole

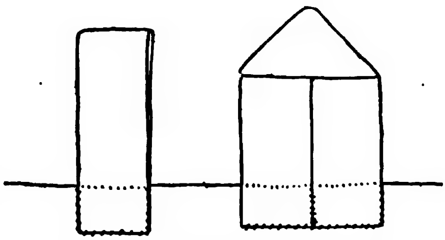
In placing the buttonhole, the kind, whether single- or double-bar, the position, and the size should be considered. The single-bar should be

placed at least one-fourth inch from the edge of the garment; the double bar, usually in the center of the plait or the hem. The distance between the buttonholes is dependent on the size of the button, where they are used, the amount of strain, and the design. A buttonhole should be about one-sixteenth inch longer than the diameter of the button. Each buttonhole should be marked with a pin or with a basting thread.

To make a single-bar buttonhole

Cutting.— Buttonholes are cut exactly on a thread of the material. This prevents uneven raveling and irregular edges. They are cut in one of the three following ways:

When the buttonhole is placed at right angles to the edge and close to it, buttonhole scissors may be used. When buttonholes are placed vertically or at some distance from an edge, one of two other methods of cutting may be used. Mark the ends of the buttonhole with pin pricks, insert the point of sharp scissors in the pinhole, and cut. Or place a pin in one end of the buttonhole and out at the other end. Fold the material in the center of the buttonhole so that the pin goes straight through. Cut a small slit at right angles to the fold, being very careful to follow the thread. Open out, insert the scissors in the small slit, and complete the cut.



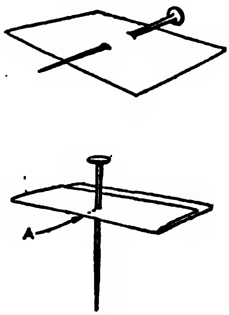
METHODS OF SEWING ON TAPES

Stranding.— The buttonhole is stranded to reenforce it and prevent its stretching. This may be done in one of two ways.

1. Hold the buttonhole in a horizontal position over the left forefinger, with the edge of the hem at the left. At the back of a single-bar buttonhole (the end farther from the edge of the hem or the end of the band) or at either end of the double-bar buttonhole, place the needle through one thickness of the material at a point one-half inch from the back end of the slit and bring it out through the slit, leaving the end of the thread about one-half inch long. When the buttonhole is finished, this end may be cut off close to the cloth and the thread will be held securely between the thicknesses of the material. Place the needle in the slit and bring it out about one-sixteenth inch below the slit, taking a stitch through both thicknesses. Take a second stitch at the other end of the buttonhole, beginning one-sixteenth inch below and bringing the needle out one-sixteenth inch above the slit; then take the same length stitch in the first end, bringing the needle out in the lower right-hand corner in

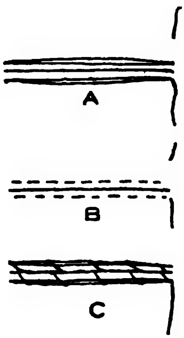
the same hole where the first stitch was started. Repeat this process, making two stranding stitches one-sixteenth inch from the slit on each side the full length of the buttonhole. This should be done very accurately, as the depth of the buttonhole stitches is determined by the distance of the stranding stitches from the slit.

2. Begin the second method of stranding in the same way as the first. Take several running stitches one-sixteenth inch from the slit on both sides of the buttonhole instead of the two long stranding stitches. This is not quite so strong or so even, but it holds some kinds of materials in place better while the buttonhole is made. This stranding may be done before cutting in silk or other slippery materials.



METHODS OF MARKING POSITION OF BUTTONHOLES

Overcasting.— The buttonhole is overcast to prevent the raw edges raveling and slipping apart. Také several overcasting stitches one-sixteenth inch deep first over the lower edge then over the upper edge of the slit, holding in the stranding. Four or five stitches are usually needed on each edge. Bring the needle out in the lower right-hand corner, holding the work in the original position. Care should be taken to watch the wrong side as well as the right to be sure that the two thicknesses of material do not slip apart.



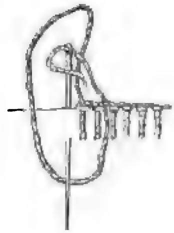
A AND B, METHODS OF STRANDING BUTTONHOLES; C, OVERCASTING BUTTONHOLE

Buttonhole stitch.— The buttonhole stitch is taken from the right to the left. It is made so that small knots, or purls, are formed on the edge of the buttonhole and strengthen it. These should be as close together and as even as possible. Place the needle in the slit, and bring it out just to the left of the place where the thread was brought out when finishing the overcasting. Throw the thread from the eye of the needle around the point from right to left, draw the needle through and up so that a knot, or purl, will be formed on the edge of the slit. Repeat this process until one side of the buttonhole is finished, keeping the stitches as even and as close together as possible.

Fan.— The fan is made at the end of the buttonhole where the button rests, and the stitches should radiate in an even semicircle, the center stitch being on a line with the slit. The purls should be very close together and a little on top of the material in order to fit around the neck of the button. To obtain this result take the buttonhole stitches a little longer and slightly farther apart. Draw the threads up slightly toward the

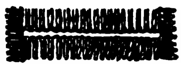
worker to form a purl on top of the material. An uneven number, usually seven, is used. Turn the work around as the fan is made, and continue the buttonhole stitch to the other end of the slit.

Bar.— The back of the buttonhole is finished with a bar. Place the needle in the slit and bring it through at the base of the last stitch. Take several stitches across the end to reenforce it. Finish the bar with blanket stitches very close together over these and through the cloth across the end to the base of the first stitch. Bring the needle through to the wrong side and fasten it with several over-and-over stitches or by running back through several buttonhole stitches.



A

B



C

A, BUTTONHOLE STITCH; B, BUTTONHOLE WITH FAN AND BAR; C, DOUBLE-BAR BUTTONHOLE

To make a double-bar buttonhole

For the double-bar buttonhole, make buttonhole stitches on one side of the slit, make a bar at the end, buttonhole the other side, and finish the first end with a bar.

Buttons

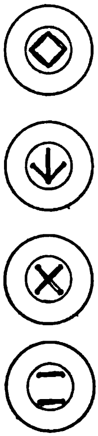
There are many kinds of buttons used for ornamentation as well as for fastening garments. Those commonly used fall into two classes:

1. Buttons with holes ....
   - a. Four-holed buttons
   - b. Two-holed buttons
2. Buttons with shanks ....
   - a. Metal shank
   - b. Bone or pearl shank
   - c. Cloth shank

Four-holed button.— In sewing on a four-holed button the stitches may cross each other on the face of the button and lie parallel on the back of the material, or vice versa. When used as a decoration a four-holed button may be sewed on with all the stitches extending from one hole to the other three or forming a square.

Use a strong single thread or a finer double thread. Begin with a knot, concealing it under the button by taking a small stitch on the right side of the material at the point where the button is to be placed. A beginning may be made with several over-and-over stitches without a knot, if desired. Run the needle up through a hole of the button, then place it down through a second hole and through the material, and draw it through to the wrong side. Place a pin under this stitch on the top of the button, and take all the rest of the stitches over it, so that the button will not be

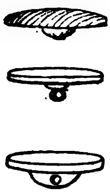
sewed tight to the material. When enough stitches are taken to hold the button firmly, bring the needle out under the button, remove the pin, and wind the thread around the stitches between the button and the cloth, to protect the stitches and to make a thread stem or shank which holds the button up from the material, making room for the buttonhole. Bring the needle through to the wrong side, and end with several over-and-over stitches. Cut the thread, leaving the end about one-eighth inch long. Do not break it off as the end of the thread will work back and the button become loosened.



METHODS OF SEWING ON A FOUR-HOLED BUTTON

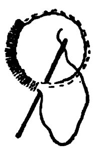
When sewing on buttons the stitches should be neat and even on the wrong side. If they are spread too far apart the material will tear out.

Two-holed button.— The two-holed button may be sewed on in the same way as the four-holed button. The stitches should be taken parallel to the warp or the woof of the material. Two-holed bone buttons with large holes may be sewed on with tapes. Buttons are often sewed to undergarments, such as children's underwaists, in this way. A narrow tape is run through the two holes and the ends are stitched under a band on the garment.



SHANK BUTTONS; TOP, CLOTH SHANK; CENTER, METAL SHANK; BOTTOM, BONE SHANK

Shank buttons.— To sew on shank buttons begin and end as for buttons with holes. Put the needle through the shank, then take a stitch in the cloth, and repeat until sufficient stitches are taken to render the button firm. For the button with a metal shank it is not necessary to wind the thread around the stitches under the button, but the cloth and the bone shank buttons are more secure if the stitches are protected in this way.



EYELET FOR SHANK BUTTON

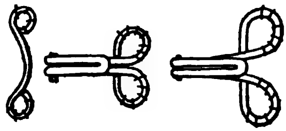
Metal shank buttons may be fastened to wash garments by slipping the shank through an eyelet and securing it with a metal ring on the wrong side. The button may then be removed when the garment is laundered and thus save wear and tear on both the button and the garment.

To make the eyelet, punch a hole with a stiletto or the point of scissors. Take a running stitch around the hole, then sew over the edge with close over-and-over stitches, keeping the hole as round as possible. Fasten

the thread on the wrong side with several over-and-over stitches. The eyelet is sometimes used in embroidery. It is then worked with embroidery floss. It may also be made with the buttonhole stitch.

Hooks and eyes

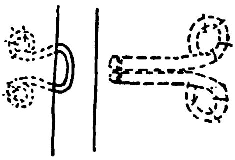
To sew on a hook.— The hook is usually placed at least one-eighth inch back from the edge of the garment. Begin without a knot at a short distance from the hook (as for a buttonhole), and take over-and-over stitches around the base. Then take a stitch in the cloth below the head of the hook, throw the thread under the flange of the hook, and continue until the head is fastened securely to the cloth. End with several over-and-over stitches close to the head of the hook, and cut off the thread.



METHOD OF SEWING ON HOOK AND STRAIGHT EYE

Hooks may be spread apart at the base if there is to be great strain on them, as this gives greater strength.

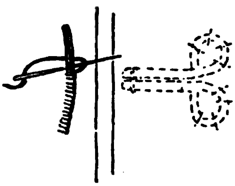
To sew on a straight eye.— The straight eye should be so placed in relation to the hook that the strain will not be on the ends, and thus pull the eye off (illustration). Sew it on with over-and-over stitches.



METHOD OF SEWING ON HOOK AND ROUND EYE

To sew on a round eye.— A round eye should extend out beyond the edge of the garment one-eighth inch. It is sewed on in the same way as the straight eye. Hooks and eyes may be sewed on with the buttonhole stitch when a very neat finish is desired.

To make thread loops.— Thread loops instead of metal eyes are sometimes used with hooks. They are less conspicuous and do not rust. They are usually one-fourth inch long.



METHOD OF SEWING ON HOOK AND MAKING THREAD LOOP

Begin with several running stitches on the line where the loop is to be, leaving the end on the wrong side. Take several, usually five or six, over-and-over stitches in the same place on the right side the length of the loops, then holding the work in a horizontal position over the left forefinger take sufficient blanket stitches over the strands of thread, but *not* in the material, to completely fill the space. Take the needle through to the wrong side, and fasten the strands of thread to the material with several over-and-over stitches. Fasten the thread with the buttonhole stitch. The blanket stitch should be taken toward the hook so that it will hook over the smooth edge of the loop.

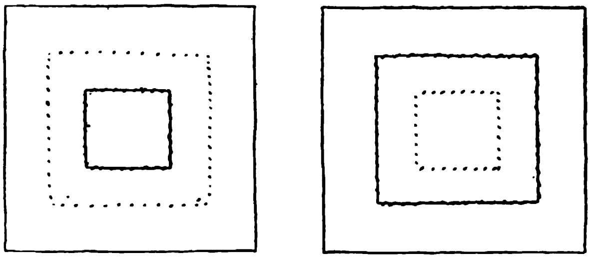
To sew on snap fasteners.— Begin by concealing a knot under the fastener as for a button, and take several over-and-over stitches through each hole. Fasten the thread securely. Sew on parts with the extension in the center first; then these may be chalked and pressed down on the opposite side of the opening to mark the place for the other parts.

REPAIR OF CLOTHING

PATCHING

Garments should be patched with material as nearly as possible like that of the garments in design and texture. Old garments should not be patched with new material. When it is impossible to patch with a worn piece, the material should be laundered thoroughly before using.

Patches are usually made square or rectangular because they are less conspicuous when the joining is with the grain of the material.



HEMMED PATCH: RIGHT SIDE (LEFT), WRONG SIDE (RIGHT)

Care should be taken to match the warp and the woof and the design, if any. In checked or striped materials, the patch is least conspicuous when the joining is made on the line of greatest contrast, that is, the dividing line between the dark and the light stripes.

The patch should be large enough to extend beyond the worn parts in order to prevent the material from wearing away just outside of the patch and thus rendering the time spent useless. Many patches in well-worn garments are poor economy of time and energy.

Hemmed patch

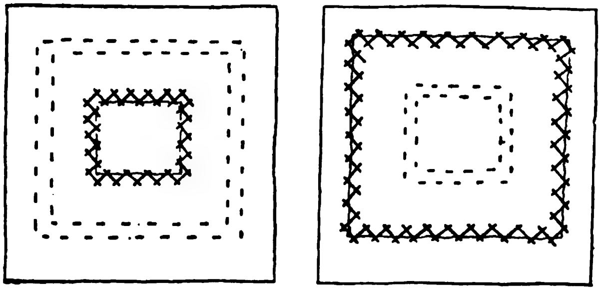
The hemmed patch is used for repairing underwear, table linen, boys' shirts, and the like.

To prepare the garment for the patch.— Place pins straight through the material in four corners of a square or a rectangle the sides of which are far enough beyond the hole and the worn parts to make a firm joining. The sides of this rectangle should also be exactly on the warp and the woof threads and, if there is any design, on the line of greatest contrast.

Crease diagonally across this space from pin to pin both ways. Cut from the hole to the pins on these diagonals. If the rectangular hole

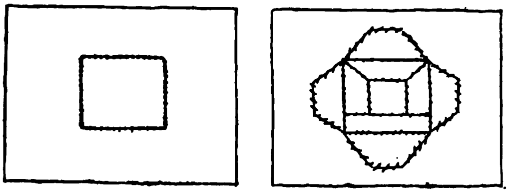
is very much longer than it is wide, do not crease diagonally, but cut to the pins on a line that bisects the corner. Great care should be taken to cut accurately exactly to the pins and not a thread beyond in order to prevent the corners raveling beyond the line of joining. Remove the pins. Crease the material to the wrong side on the line of joining and trim, leaving one-eighth to one-fourth inch beyond the turning according to the fineness of the material.

To place the patch in the garment.— Lay the patch under the hole, matching the design and the warp and the woof. Pin it on four sides, and baste and hem it carefully into place. Begin the hemming stitch in the middle of one side and take stitches closer together around the corners.



FLANNEL PATCH: RIGHT SIDE (LEFT), WRONG SIDE (RIGHT)

Remove the bastings and turn to the wrong side. Measure one-fourth to one-half inch beyond the line of the hemming stitches for the edge of reenforcement, which is to extend beyond the line of joining. Crease on this line, giving due regard to the grain of the material and the design, trim the edges, leaving one-eighth to one-fourth inch for turning, and baste and hem them into place. The hemmed patch is very strong because of this reenforcement beyond the edge of the hole.



OVERHANDED PATCH: RIGHT SIDE (LEFT), WRONG SIDE (RIGHT)

Flannel patch

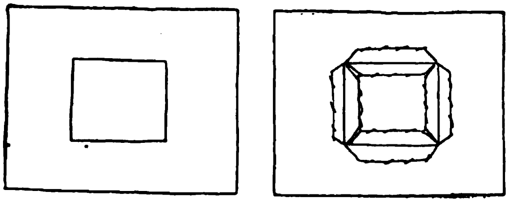
The flannel patch is used in flannel garments, such as baby blankets, petticoats, and the like.

To prepare the garment for the patch.— Cut out the material around the hole, following the warp and the woof, in a square or a rectangle the edges of which are to be the line of joining. Place the patch under the hole, matching the warp and the woof and leaving about one-half-inch extension beyond the edge of the hole for reenforcement. Baste and catch stitch the raw edges into place on both sides of the garment. Begin the catch stitch in the middle of one side, and turn the corners evenly.

The overhanded patch

The overhanded patch is less conspicuous than the hemmed patch, but it is not so strong. It is used on outer garments usually where there is not much strain, to repair tears in children's dresses, and the like.

To prepare the garment for the patch.—Proceed as for the hemmed patch in preparing the garment.



STITCHED PATCH: RIGHT SIDE (LEFT), WRONG SIDE (RIGHT)

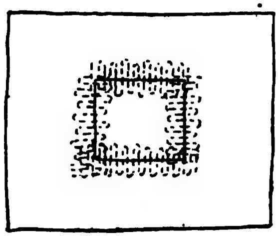
To place the patch in the garment.— Place the patch under the hole, matching the warp and the woof and the design. Place pins at the corners of the patch, and crease the four sides to the wrong side on the line of joining so that the patch exactly fits the hole.

Place the folded edge of the patch to the folded edge of the garment, the right sides together, and overhand one side at a time. The stitches at the corners should be taken closer together than on the sides. Care should be taken not to sew through more than two folded edges at the corner. Trim the edges to one-fourth inch. The corners may be finished in two ways: cut diagonally to form a miter; cut square to make a stronger corner. The edges of the overhanded seam are creased open and overcast.

The stitched patch

The stitched patch is used to repair garments made of heavy cotton or wool materials, such as overalls, wool shirts, men's suits, coats, and the like.

To prepare the garment for the patch.—Proceed as for the hemmed patch in preparing the garment.



DARNED-IN PATCH

To place the patch in the garment.— Apply the patch to the garment in a one-fourth-inch seam, using the stitching stitch. Care should be taken in turning the corners to "full in" the patch a little, that is, to hold it a little full to prevent puckering. Open the seam, press it, cut the corners diagonally, and overcast the edges.

The darned-in, or fine drawing, patch

The darned-in patch is used in repairing fine table linen. It is very inconspicuous but not so strong as the other patches, and requires a longer time and closer application.

Cut the material away from the worn part in a square or a rectangle. Cut the patch exactly the size of the hole, matching the warp, the woof,

and the design. Baste the right side of the article and the patch to paper to hold it in position. Begin about one-quarter inch from the line of joining, and take fine running stitches at right angles to this line to a point about one-fourth inch beyond it. Sew back the same way, taking rows of running stitches very close together. Continue sewing back and forth, being careful to take a stitch first over and then under the edge at joining. Make the rows of running stitches of uneven lengths so that the strain will not come on the same set of threads where the turn is made. Make the corners on the article double or single according to the strength desired.

The patch may be sewed into the article by taking each stitch over one edge and under the other, and so on, instead of using the running stitch. This can be done only in very fine material. A warp raveling is often used because it sinks into the grain of the material inconspicuously. Stitches are taken about one-eighth inch on either side of the line of joining.

DARNING

Darning is a method of repairing knitted and woven materials by weaving threads back and forth across an opening in such a way as to fill the hole with material as much like that of the garment as possible. Exquisite darning is done in some countries by cutting out the worn section and filling in the hole by reproducing the knitted loops with the needle. A piece may be set in in this way, also. However only the common method of weaving across a hole is discussed here.

Darns in knitted materials

Thread should be used as much like the thread of the garment to be darned as possible. For heavy ribbed stockings, three strands of darning cotton are used, while one strand may be used for very fine stockings. Mercerized darning cotton is particularly good for light weight stockings as it is more easily drawn through the material.

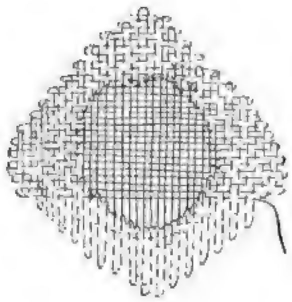
A slender, long-eyed needle is used for darning. Clumsy results are obtained when too coarse a needle is used.

Darning may be done over the hand or over a darner or a darning egg. The darner over which the work is secured by a metal spring is the most satisfactory as it prevents the material from being stretched out of shape.

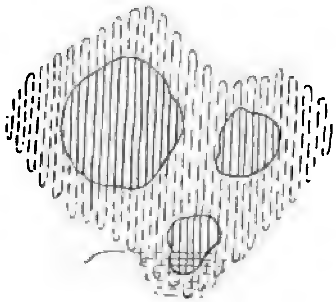
The darn should be elastic, as knitted material is elastic. Worn parts about the hole should be reenforced. The darn should be smooth on both sides of the garment. There should be no ridges at the edge of the hole, and no loose ends.

The stockinet darn.— The stockinet darn is used in underwear, sweaters, mittens, and the like. It is made on the wrong side of the garment. This

darn is usually made somewhat diamond shaped so that the strain will not come on one set of threads and the darn will be more elastic as well as stronger.



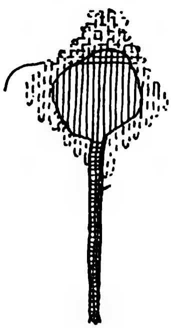
STOCKINET DARN



DARNING SEVERAL HOLES CLOSE TOGETHER

Begin on the wrong side without a knot, far enough from the edge of the hole to reenforce the worn part, from one-fourth to one-half inch. The first set of threads is put in lengthwise of the garment, in the same direction as the ribs or the lines of loops. Rows of small running stitches are taken in the garment to the edge of the hole. Then the thread is carried across the opening to form the warp threads of the material to be woven to fill the hole, and the running stitch is continued on the other side. Take several small running stitches from the starting point, turn, and take a second row a little longer and very close to the first row, leaving a small loop of thread at turning to allow for elasticity of the darn. Continue the rows of running stitches, keeping in mind the diamond shape of the finished darn. These running stitches may be taken through the loops of thread only so that they will not show through on the right side.

When the hole is reached, catch the loop at each edge with the needle to prevent raveling. Finish the lengthwise rows of running stitches far enough beyond the edge of the hole to reenforce the worn part.



DARNING A HOLE AND A RUN

Begin the crosswise rows of stitches the same distance above the edge of the hole and take them over and under the first set of threads. When the edge of the hole is reached, make the weaving across the hole very even and firm, at the same time being careful not to make the darn thicker than the mesh of the material. Leave small loops at the turnings, and keep the darn diamond shaped.

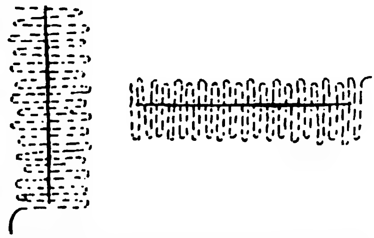
When the hole is very uneven the shape of the darn may be varied accordingly.

The stocking darn.— For the ordinary hole in stockings, a modification of the stockinet darn is used, called the stocking darn.

The darn may be made on the right or the wrong side, or half on the wrong side and half on the right side if preferred. The procedure is the same as for the stockinet darn except that the running stitches are taken through to the right side usually, as the loops in the stocking are too fine to be caught on the needle as in a sweater or in underwear.

To darn several holes close together.— Make one large darn so that the running stitches will reenforce the material between the holes. It is not always possible to keep the diamond shape, but care should be taken to prevent strain coming on one set of loops.

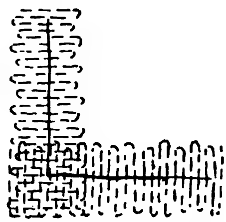
To darn a run in a stocking.— Runs that are both long and wide are scarcely worth the time spent in darning them, for if filled in many hours of close work are required, and if drawn up the stocking is made so much smaller that it will burst out again immediately.



DARNING A WARP (LEFT) OR A WOOF (RIGHT) TEAR

When the stitches have raveled just a short distance from a hole, however, the run should be darned with the hole, weaving over and under two threads at a time, and taking care to catch the loops at the bottom of the run to prevent further raveling. Usually it is only necessary to darn the run one way.

When a long run is made by one loop raveling out, the loop at the bottom may be caught with a crochet hook and crocheted up the little ladder of crosswise stitches.



DARNING A HEDGE, OR CORNER, TEAR

Such a run may also be drawn together with an over-and-over stitch, being careful to catch the loop at the bottom. Threads may also be woven in as in an ordinary darn.

Darns in woven materials

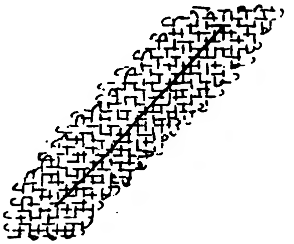
The thread used should match the thread of the material to be darned, as nearly as possible. A warp raveling of the material is often used. Split silk and hair are sometimes used for darning wool materials.

Running stitches should be taken parallel to the warp or the woof and at right angles to the tear if it is on the straight of the material. Care should be taken not to draw the darn too tight. The sides of the tear may be basted to paper to hold them in place.

Worsted suitings, silks, flannels, and sometimes cotton garments and table linen are repaired by darning.

To darn warp or woof tear.— Begin without a knot on the wrong side of the garment, slightly beyond the end of the tear. Take rows of running

stitches very close together about one-fourth inch on either side of the tear and at right angles to it, being careful to take the stitch over one edge and under the other, weaving in any loose threads at the torn edges. It is usually necessary to darn the straight tear only one way.

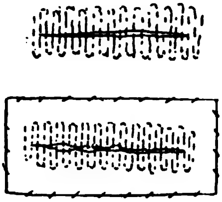


DARNING A DIAGONAL TEAR

Rows of running stitches should be of uneven lengths in order to prevent the strain coming on one thread at turning.

To darn hedge tear, or corner tear.— Proceed as for straight tear, making the corner double and keeping the stitches at right angles to the tear. Replace warp threads first.

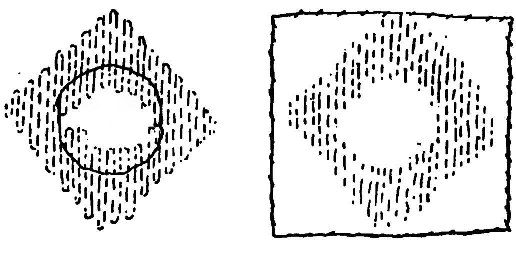
To darn diagonal tear.— Replace the warp threads first, then the woof. Running stitches in this case are *not* taken at right angles to the tear.



REENFORCED DARNED TEAR: RIGHT SIDE (ABOVE), WRONG SIDE (BELOW)

To reenforce with a piece of the material.— If the tear is very ragged at the edges, a piece of the material may be placed underneath, matching the warp and the woof, and the tear darned down to it, taking stitches on the right side. The edges of the piece may then be overcast or catch stitched to the garment invisibly.

If a hole is worn in the garment, a piece is placed underneath, matching the warp and the woof and the design, and the edges of the hole are darned down to the piece on the right side. The edges of the piece may be overcast or catch stitched to the garment invisibly.



REENFORCED DARNED HOLE: RIGHT SIDE (LEFT), WRONG SIDE (RIGHT)

SUGGESTIVE PROBLEMS

TABLE RUNNER

One and one-half yards of Russian crash or narrow unbleached linen toweling. A three-inch hem on each end secured and decorated by a group of running stitches in old blue, green, or brown rope embroidery floss.

DUST CLOTH

One square yard of cheesecloth. One-fourth to one-half-inch hem hemmed by hand. The ends overhanded. Square corners made.

NAPKIN

Small linen damask napkin. A damask hem one-eighth inch wide.

BROOM BAG

Canton flannel twelve by thirty-six inches with the nap on thc outside. French seam on the sides, one-half-inch hem at the top. The opening for the tape buttonholed. The broom bag may be made double.

SEWING BAG

Blue, tan, green, or pink chambray gingham twelve by thirty-six inches or smaller if desired. French seams on the sides. The heading and casing two and one-half inches wide. Chainstitching in white mercerized embroidery floss used to secure the hem and to make the casing. Name or initials outlined with chainstitch. Openings for the tapes buttonholed.

TOWEL

Huckaback one yard long, any width. A hemstitched hem one or two inches wide. Initials cross-stitched in the center of one end of the hem. Design in cross-stitch may be worked also.

COLLAR

Lawn, organdie, batiste, or any sheer white material one-half yard square is required to cut a large square collar. Hem one and one-half inches wide, turned once, and featherstitched with no. 80 crochet cotton in wall of troy design. Corners mitered. Neck finished with a bias band.

HANDKERCHIEF

One-fourth yard square of handkerchief linen. The edge finished with a rolled hem whipped both ways so as to form a cross-stitch on the edge. This may be done with two different shades of any of the delicate colors.

PETTICOAT

Three lengths of striped or plain chambray gingham. French seams. Bound placket. Four-inch hem. Adjusting gathers, putting on band. Buttons and buttonholes.

NIGHTDRESS

About three yards of muslin, longcloth, cambric, or nainsook. Cut kimona style. French seams. Hem two inches wide, hemming stitch. Bias facing around the neck and bottom of the sleeves. Lace whipped on the neck and the sleeves. Buttonhole in the facing for ribbon or lingerie tape.

REFERENCES

The following are some of the books that would be helpful additions to the library of any school that takes up the work in sewing:

Clothing for women. Laura I. Baldt. J. B. Lippincott Co., Philadelphia, Pennsylvania.

Dressmaking. Jane Fales. Charles Scribner's Sons, New York.

A sewing course. Mary Schenck Woolman. F. A. Fernald, Washington, D. C.

Clothing and health. Kinne and Cooley. The Macmillan Company, New York.

Shelter and clothing. Kinne and Cooley. The Macmillan Company, New York.

The dressmaker. Butterick Publishing Company, New York.

Art in needlework. Lewis Day. Charles Scribner's Sons, New York.

IDEALS

Every human being needs to keep bright the vision of what he may become. He needs constant courage to follow the vision. One great source of help is the ideals that have been expressed in literature.

Thou must be true thyself,
  If thou the truth wouldst teach;
Thy soul must overflow, if thou
  Another's soul wouldst reach!
It needs the overflow of heart
  To give the lips full speech.

Think truly, and thy thoughts
  Shall the world's famine feed;
Speak truly, and each word of thine
  Shall be a fruitful seed;
Live truly, and thy life shall be
  A great and noble creed.

*Be True**
by HORATIO BONAR

One who never turned his back but marched breast forward,
Never doubted clouds would break,
Never dreamed, though right were worsted, wrong would triumph,
Held we fall to rise, are baffled to fight better,
  Sleep to wake.

From *Epilogue*
by ROBERT BROWNING

*Reprinted by courtesy of Doubleday, Page and Company.

Not one holy day, but seven.
Worshipping not at the call of a bell but at the call of my soul.
Singing, not at the baton's sway, but to the rhythm in my heart.
Loving because I must,
Giving because I cannot keep,
Doing for the joy of it.

From *My Little Book of Prayer*
by MURIEL STRODE

Truth is within ourselves; it takes no rise
From outward things, whate'er you may believe:
There is an inmost centre in us all,
Where truth abides in fulness; and around,
Wall upon wall, the gross flesh hems it in,
This perfect, clear perception—which is truth;
A baffling and perverting carnal mesh
Blinds it, and makes all error: and "*to know*"
Rather consists in opening out a way
Whence the imprisoned splendor may escape,
Than in effecting entry for a light
Supposed to be without.

From *Paracelsus*
by ROBERT BROWNING

I would be true, for there are those who trust me,
I would be pure, for there are those who care,
I would be strong, for there is much to suffer,
I would be brave, for there is much to dare,

I would be friend to all—the foe, the friendless,
I would be giving and forget the gift,
I would be humble for I know my weakness,
I would look up and laugh and love and lift.

My Creed
by HOWARD ARNOLD WALTERS

How do you like to go up in a swing,
  Up in the air so blue?
Oh, I do think it the pleasantest thing
  Ever a child can do!

From *The Swing*

by ROBERT LOUIS STEVENSON

PART III

A MESSAGE TO THE TEACHERS OF RURAL AND ELEMENTARY SCHOOLS

LAYTON S. HAWKINS
Director, Division of Agricultural and Industrial Education, University of the State of New York

It seems difficult for us to realize that we, the people of the United States, are really at war with Germany. We have been teaching from our histories facts about the great War of the Revolution and the Civil War without any real conception of what war time means. To us, as well as to the children, these wars seem like legends handed down from days gone by when men actually laid down their lives to save this country. We see the veterans of the Civil War yearly growing fewer in number, and the tales of that war grow less meaningful as the numbers of those who can remember the happenings become smaller. Now we are again at war, and as yet it hardly seems possible to us that men, women, and children are dying daily for the cause of liberty. Yet we know that such is the case. Our papers are daily relating tales of bloodshed and ruin, and occasionally some of our own countrymen are numbered among the missing.

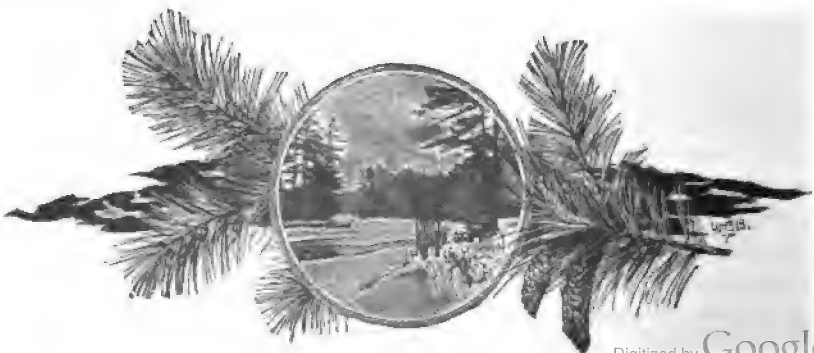
We are planning to raise a great army the members of which will come from the flower of our young manhood. The physically strong will be called upon to risk their lives in the trenches. Our brothers and our friends will soon be face to face with the enemy. Anxiously we will then be waiting to hear from the front. Not until we get the news that an acquaintance, a friend, or a brother, has been wounded or killed will we truly begin to realize the horror of this war.

During all this excitement of fighting and preparation for fighting the younger people have been wondering what they could do to help, and you teachers will undoubtedly be besieged with questions from them concerning what they can and ought to do. No doubt these youngsters feel that some kind of action on their part is necessary, and I believe that now, as never before, there is opportunity for the teacher to organize the pupils of the school into a real civic organization. There are many things that the school can do in the way of assisting the local Red Cross, the local grange, and other organizations engaged in some work contributory to the successful prosecution of the war. Above all, the children

ought to be led to see that the time is coming, and that not far distant, when they will be called upon to live for that liberty for which the older brothers are now called upon to fight. In other words, after all the battles have been fought and the war ended, there will still be the great question of building up this country and the other countries of the world to the standard of liberty that will really justify all the lives that have been lost.

In order that the schools may do their part in this great work it is absolutely necessary that all those who are engaged with the schools should turn their hands to work, their minds to thoughts, and their spirits to cooperation for the future peace and welfare of the whole world. After the war is over and the regular business of the country is resumed, there will be great need of persons who have had the advantages of a good education. The country will need trained leaders. Thus the school children should be led to see that they are performing the greatest service by remaining in school, and by doing from day to day the work that is assigned them in the very best way that they know how.

The question of food production is now, and will be for the period of the war at least, one of the most vital questions which we as a nation and which the whole world will have to face. One of the things which the teacher can do to assist in this question of food production is to get the boys and girls started on some productive project work at home. The State has now made provisions whereby the Commissioner of Education is authorized to assist school districts in the payment of the salary of a supervisor or a director of agriculture. Properly qualified teachers who have productive projects under way and whose board of education will engage their services for the summer months for the supervision of these projects, have an opportunity to do a great piece of work in assisting in the education of children through food production and conservation. Communications regarding this should be directed to the Division of Agricultural and Industrial Education, Education Department, Albany, New York.



NOTES AND SUGGESTIONS

THE EDITOR

MORE than any other one thing the work that Miss McCloskey did through the Cornell Rural School Leaflet was characterized by its genuineness, and its sympathy, and its understanding. It is my hope that the relationship between the members of the staff of the State College of Agriculture and the teachers in the public schools, may continue to be marked by the same spirit, and that you will feel our pleasure and real interest in cooperating with you in any way in our power.

It is my good fortune to meet many of you at teachers' conferences, school fairs, field days, and other educational gatherings, and from such associations and the opportunities growing out of a large correspondence, many suggestions arise that it may be profitable to present for the consideration of all. These will be found in the following paragraphs together with some notes on various phases of the work that it is desirable to emphasize. No particular order has been attempted, the different topics being more or less unrelated and complete in themselves.

THE REDUCED LEAFLET

As originally prepared, the material for this leaflet was equivalent in quantity, quality, and wealth of illustration to the September 1916 number. The increased cost of printing made it necessary to reduce the amount, and for this reason it was found necessary to shorten the leaflet about one-fourth. It was impossible to reprint articles even when called for by the Syllabus.

Among the articles that had to be withdrawn were: two on winter birds, the evening grosbeak and the cedar waxwing; a new article on the Babcock test, replacing the one that has been used for years; material on the locust borer and the cabbage aphis, offering an additional insect of both the biting and the sucking type; articles on potato diseases and methods of cooking potatoes; three forestry articles, entitled *Our Forests*, *Forestry in the Rural Schools*, and *Propagating Trees in School Gardens;* two articles by school garden experts; and numerous notes and letters from teachers which were full of helpful suggestions.

A WORD OF COMMENDATION

I am moved to say a word in praise of the work that elementary teachers in the State are doing. It is not always easy in the midst of the daily routine of the schoolroom for you to keep faith in the worthwhileness of your work. For some reason the major emphasis and recognition have always been given to the higher levels of educational activity, and those who day by day quietly and steadily build in little children a foundation on which any superstructure in later years must be built, seldom receive due credit for their unselfish service.

A WORD OF WARNING

There are some who misuse nature study. Because the work is outlined in the State Syllabus, and because grade examinations are given in nature study, such teachers feel impelled to consider the subject, but have made no effort, or, in some cases, have made effort unsuccessfully, to see clearly and to apply correctly the principles involved. There are still cases, although, I am glad to say, they are becoming fewer all the time, where teachers use their September leaflet as a textbook, and where all the work that the children do in nature study is book work on a formal recitation basis without any contact with real things. These are the teachers who complain about the addition of nature study to an already overcrowded curriculum. Indeed, it would be better, as far as any value derived from the work is concerned, for them not to touch it at all.

No teacher should feel compelled to follow the Syllabus and this leaflet strictly and in their entirety; they should be used more than anything else as guides, and, so used, are desirable and helpful. There are schools in the State that cover each year much more ground than is called for by the Syllabus, and there are other schools, doing very good work, that cover much less. Of primary importance are the nature and the quality of the work. Quantity comes with experience and long association.

There is no reason why any teacher who will read carefully the introductory articles and the explanatory notes in this leaflet, should fail to catch the spirit of the work. Its value lies in its contact with real things, and the way in which it ties to life. Rightly used, nature study is a source of abundant joy, greater unity of interest, increased capacity for productive effort, and larger resourcefulness on the part of the boys and girls and of the teacher.

CORRELATION

You will notice in reading the extracts from teachers' letters that are given in the fore part of this leaflet, that a great many mention the use of nature study in connection with other kinds of work, notably with

drawing and with English. There can be no question that the environment should color the whole school day, and find a natural reflection in all the activities. Yet there are several dangers in this matter of correlation.

One danger is the fact that too constant recurrence to a given subject, even though it may be from many different angles, is likely to wear away the genuine interest that was first shown, and to go far beyond the extent of investigation legitimate at the time. A child should be helped to grow in any experience that he has with some force or phenomenon of his environment, but it should not be expected that he exhaust the subject thoroughly all at once. That teacher is wisest who will recur to the subject from time to time and who keeps in mind all the various incidents of the school life and the way in which they may subsequently be tied together. Of course, there is abundant enough material afforded by the environment to offset this tendency by the use of many different subjects, yet it is none the less true that there is danger in using an experience with a bird, or a flower, or something else, so repeatedly that it becomes tedious.

Another danger lies in the fact that too great a tendency to correlate nature study with other subjects is likely to lessen the consideration of nature study for itself. This should not be permitted to happen. There has been a good deal of discussion regarding the desirability of a definite place in the school program for nature study. It seems to me that it is desirable that nature study be so recognized, but the period need not be absolutely fixed, nor should nature study interest be confined solely to that period. The definite period might best be used, perhaps, as a sort of council at which the different experiences since the preceding one are brought together, lessons drawn from them, records made, and plans outlined for future activities. But the true nature study lessons will come at many and at odd times, in school and out of school, during recitations, at recesses, between classes, at times when a flower is brought in, when a bird visits the feeding station, when the first snow falls, when a herd of cattle passes, when a hen is hatching her eggs, when any question arises.

CHILDREN'S LEAFLETS

I want to urge those of you who are teaching under rural supervision (including all grade teachers in villages up to 5000 population) not to fail to make use of the opportunity to obtain for the children the smaller leaflets that are issued three times a year — in November, January, and March. A blank will be found next to the back cover of this leaflet, which is to be used in sending to me the names of your pupils, and which,

when placed on file at the College, will entitle you to as many copies of each leaflet as you have children, plus one for yourself.

The most distinctive feature of the leaflets is the correspondence between the children and myself. In every number of the leaflet I write a signed letter, which I hope you will encourage each boy and girl to consider as a personal message.

CHILDREN'S LETTERS

The boys and girls are urged to answer the letters in the leaflets, and many thousands of them do so each year. The letter writing should prove helpful in the English work, especially since the letters are to go to a real person who will read them with sympathy and understanding. I have no spirit of criticism of the work of the school in my attitude toward the children's letters. Naturally I am always glad when I feel that the children are growing in strong and wholesome ways, and I am always sorry when I feel that they are not growing; but it is not my wish, nor have I the authority, to take any action one way or the other. The letters should provide a spontaneous outlet for the children and give them a means of self-expression which you can use to good advantage.

Letters are often written as a school exercise, but in this case effort should be made to have them individual in character, to have each child express himself or herself freely and without restraint. Care should be taken to send the letters that are written to me without delay or undue effort at correction. I shall read them carefully, sending a personal answer whenever possible, although this must not always be expected, and each letter will be credited to the child who wrote it. When three letters have been written during the year, between the opening of school in September and the following September, a small gift picture will be sent, to become the child's personal property. These gift pictures are selected for their interest to the children and for their art value, and those boys and girls who have obtained them in years past, seem to appreciate them very much.

CORRESPONDENCE WITH ANOTHER SCHOOL

It will be discovered in the children's leaflets that opportunity is offered for beginning a correspondence between your school and a school in another part of the State. Wherever this has been tried fairly and earnestly, it has proved of great value as a source of stimulation, and also as a source of information. Naturally it is desirable to begin such an intercourse early in the year in order that it may have time to develop. If the idea appeals to you it would be well to discuss the matter with the children, and to choose together some section of the State with which

you would like to be in touch for the year. Then, if you will write to me, giving the name of the county that you have selected together with the name and address of some older pupil in the school who will act as secretary to receive and to send the letters that all the children write, I shall be glad to locate a school in the county that you indicate and to extend mutual introductions.

The correspondence between schools is especially valuable in connection with the nature study work because there are always local differences in flora and fauna, in topography, in industries, in types of agriculture, and in ways of living.

OTHER ACTIVITIES

It is impossible to mention at length the many suggestions for study and activity that are made through the children's leaflets. You should be familiar with them as they appear, and, discussing them with the children, make use of such as apply to the conditions of your school. Attention is particularly directed, however, to those that are in continued application from year to year, such as songs, games, the celebration of Corn Day, the preparation of exhibits for Farmers' Week, the testing of seeds, and the making of gardens.

THE SCHOOLROOM

The schoolroom should be a pleasant place in which to live, and, first of all, it should be clean. I know that there are sometimes difficulties in bringing this about, but I am sure that nothing is more important, and that it would be time well spent to make the physical surroundings right before attempting to stimulate mental development. It is not always possible to change radically the character of the schoolroom without the cooperation of the community, and this is sometimes difficult to gain; but at least cleanliness and order can prevail. If you are interested in the improvement of schoolroom interiors, and do not already possess a copy of the April 1914 number of the leaflet entitled *Decoration for the Rural School*, I shall be glad to send you one if you will write to me for it. Right standards have been given in this leaflet by Mr. Farnum of the State Department of Education, which should serve as a guide for any improvements you may make.

REFERENCE BOOKS

Few things would do more to make possible greater growth in nature study than the addition to the school library of some of the fundamental reference books relating to the different phases of the work. I am not now thinking of so-called textbooks, but, rather, of books that are author-

ities on the fields which they cover. It is true that one good book on trees will open up that whole subject to the children and make possible of identification practically all the species that they can find. This also holds true in the case of a book on weeds, or wild flowers, or insects, or birds. I know that you have an opportunity each year to make some suggestions in regard to needed additions to the school library, and I earnestly believe that there are few additions that you could recommend of such great value educationally as some of the fundamental books such as I have indicated.

Those of you who were fortunate enough to attend Farmers' Week last February will recall the remarkable exhibit from a little rural school of seven pupils, which contained seventy-six different tree mounts, three hundred and seventy-five kinds of weed seeds properly identified and mounted in bottles, and over three hundred and fifty pressed specimens of plants, in addition to numerous other things. It would have been quite out of the question for this school to have produced any such results without the good reference books that I happen to know it possesses, books that were bought mainly with money obtained at county fairs, by school entertainments, and the like.

On page 318 you will find a suggestive list of reference books that have proved themselves to be among the best in their respective fields, and you would make no mistake in adding to the school library any of these books.

CONTACT WITH THE COMMUNITY

The thought that is often expressed of using the community to solve some of the questions that arise in the school work, naturally brings up the whole matter of your relation to the community. There are, of course, many things that could be said, but, in brief, it should be a relationship of sympathy and understanding, which can only be brought about by mingling with people in a direct, human way, and by making an earnest effort to know something of their activities and of the industrial or agricultural conditions and methods that prevail. In other words, you need to know something of the influences that surround the boys and girls outside of school and something of the experiences with which their lives are filled, in order that you may have a bond of common interest with them and know how to make use of the resources that they all possess in giving them greater strength and courage.

SUMMER SCHOOL

The New York State College of Agriculture maintains a six-weeks school each summer, primarily designed to meet the needs of rural teachers.

Tuition is free to residents of New York State, and aside from the technical information to be obtained, which cannot help but increase one's efficiency as a teacher, contact with a great university and with the many persons who come from many places brings an inspiration and a spirit that makes all of life richer.

Each year some rural teachers find their way to the College on their own responsibility, but there are other movements on foot with which you should be familiar.

The New York State Grange offers twelve scholarships of fifty dollars each, awarded on a basis of competitive examinations held in June each year, and open to persons who are members of the grange and between eighteen and twenty-five years of age. The scholarships are applicable either for the six-weeks summer school for teachers, or for the twelve-weeks winter course in agriculture and home making. There is no reason why a large number of these scholarships should not be obtained by rural teachers, who would thus have the opportunity to prepare themselves more effectively for their work and to have a rich personal experience.

Perhaps the most significant and hopeful movement, however, comes from two supervisory districts in the State where the teachers themselves have taken the initiative. In one of these, the first supervisory district of Allegany County, the teachers provide a fund by contributing one dollar apiece to send one of their number each year to the summer school at the New York State College of Agriculture. The person to whom the scholarship is awarded is nominated and elected by all the teachers. This has been going on now for four years, and the practice has been to select a teacher from a different township each year. Of course the teacher is obliged to return to the district to teach during the following year, and to be ready at teachers' conferences and at other gatherings to contribute freely of the experiences which have been hers while at the State College.

Last summer the second supervisory district of Orleans County followed the plan, and I am greatly in hopes that in other supervisory districts sentiment may crystallize among you teachers to take the same step. It is, of course, an unselfish move in one way, because most of you could not expect to obtain the scholarship; but, on the other hand, you will be making possible a fundamental development in the work and indirectly influences from it will reach each of you. It must be a whole-hearted movement wherever it is undertaken. In the two districts that I have just mentioned there are no teachers who hold back; the contribution is given readily and without hesitation by every teacher, and the fund is completed each year without the necessity for elaborate solicitation, a thing which, by its very existence, would defeat the spirit of

the movement. I am looking forward to the day when news will reach me of a third supervisory district in the State to take this action, then a fourth, a fifth, a sixth, and so on until there are a goodly number. I often wonder in what part of the State the next district to take action will be.

GRAYSTONE HOUSE

I have been writing these notes and suggestions while sitting in the great room at Graystone House on a beautiful June afternoon. Those of you who received the September leaflet last year are familiar with the external appearance of the house and with the appearance of the great room. It is a place of inspiration and growth, dedicated by Miss McCloskey to her friends and associates in the work who could sense and appreciate its quality, and who earnestly desired to find more fully "the abundance of life."

I want you to feel that you have a share in Graystone House. It gave me sincere regret not long since to receive a letter from a teacher in which she mentioned having spent the week-end in Ithaca and having passed Graystone House on Sunday morning with a desire to enter, but not quite daring to do so. The great room is always ready to receive those who have an earnest attitude to life, and particularly those who are concerned with the teaching of little children. If it ever comes to any of you who read this to be in Ithaca, and if you are moved to touch in a more direct way the associations that surround Graystone House, I hope you will not hesitate to do so.

MISS McCLOSKEY'S MESSAGE

It is my hope gradually to collect material that will serve to express the message that Miss McCloskey had for the world. Part is to be found in her writings for the leaflets and in other publications, although she never wrote a great deal. Life in contact with people was too absorbing in its demands. Her great messages went out in the spoken word and by letter. If any of you who read this had the opportunity of hearing Miss McCloskey, or of reading something which she had written, or of receiving a letter from her, and were helped particularly by something that she said, I earnestly wish that you would send it to me together with some little statement of the circumstances involved.

Let me close these notes with the wish that the coming months may bring to each teacher faith, courage, patience, tolerance, unselfishness, a gentle firmness, humanness, and a desire to leave an impression on young lives that will be strong, and wholesome, and liberal, and true. May your outlook to life respond to the ideals expressed so beautifully in the bits of literature on pages 252 and 253.

PHYSICAL TRAINING

THE EDITOR

DUE to the fact that the subject of physical training, which is of such vital interest and importance at the present time, affects so greatly the welfare of boys and girls, and relates in so many ways to their environment, it has seemed legitimate and desirable to include in this leaflet some discussion of the question, principally with a view to helping teachers to understand better their relation to the work.

The compulsory nature of the physical training law that went into effect last year, necessarily brought into being a great many difficult problems, not all of which could be successfully solved at the beginning. There has been considerable opposition on the part of trustees, parents, and communities, but this has practically disappeared in all cases where earnest, effective work has been done, the worth while results thereby becoming clearly apparent.

Few things have come to the schools that can mean so much as the work in physical training. If there were no other effect than the attention to personal hygiene, it would be invaluable, but when we add to this the development toward bodily perfection which comes through the setting-up drills, and the opportunities for relaxation, wholesome activity, and group effort afforded by directed play, the possibilities are beyond calculation.

Rightly used the work in physical training will be an added bond between teacher and pupils, and ultimately between the school and the community. It has in it the great elements of human association, direct relationship to life, order without formalism, and freedom under control, which are basic principles in true educational growth.

It is important that we understand clearly the relation of physical training to the whole life of the child. Of necessity it has had a great deal of emphasis of late, and there can be no doubt of its fundamental importance to all other kinds of activity — physical, mental, moral, spiritual. We are fortunate in having on the following pages two articles that should serve to give a clear conception of the work in its relation to the rest of education, and of the position of the regular teacher with respect to the physical training activities. Dr. Storey is directly in charge of the administration of the work in accordance with the syllabus that was prepared last year by the Military Training Commission, and approved by the Board of Regents of the State of New York. Dr. Storey

has presented a broad view of the work, its possibilities, its requirements for the coming year, and the obligations assumed by superintendents, supervisors, teachers, children, and parents, and he has concluded his article with a direct discussion of the teacher's relationship to the work.

Mr. Chase is an assistant in the work under Dr. Storey, and has been assigned specially to the physical training activities in rural schools. Many teachers have had the opportunity of meeting him at conferences during the past year, and know something of his earnest attitude and belief in the work. His article contains a simple, direct message, which marks his touch with the work. It is always worth while to have a frank statement of conditions, to recognize whatever shortcomings we may have, and to be encouraged and inspired to make greater effort for better results in the future.

THE NEW YORK STATE PROGRAM OF PHYSICAL TRAINING

THOMAS A. STOREY
State Inspector of Physical Training

The program of physical training that was made a part of the rules and regulations of the Regents of the University of the State of New York this last year, is the joint product of two legislative enactments. The first of these enactments, Chapter 566 of the Laws of 1916, creates a Military Training Commission, and places certain obligations upon that Commission. One of these obligations is to devise with the Regents a program of physical training for application in the schools of the State. Another obligation is to appoint a State Inspector of Physical Training and such assistants as may be necessary for the purpose of inspecting the operation of the physical training program in the schools of the State. This Commission has other duties than these, but those duties do not concern us here.

The second act of the Legislature made it a law that physical training should be given in all elementary and secondary schools, public and private, to children of both sexes of eight years of age or over. This state program of physical training then has been devised by the Military Training Commission and the Regents of the University, pursuant to the provisions of Chapter 566 of the Laws of 1916, and that program is now being operated in the schools of the State in conformity with the provisions of Chapter 567 of the Laws of 1916.

The program and syllabus issued by the Military Training Commission and later by the Department of Education, forms a publication of about three hundred pages. The general plan, or program, is covered in something like twelve pages, while the remainder of the text is devoted to the

syllabus. In this program physical training is interpreted in terms of health education. The general plan, or program, is made up of five divisions.

The first division, Physical Training A, establishes a correlation between the work of the class teacher and that of the medical inspector or other health examiner of the school. It provides for a daily class inspection by the regular teacher and thus recognizes the importance of the class teacher in relation to the health habits of the school child and in relation to the school influences that may affect the health of the school child. There are over eight thousand one-room schools in the State of New York. The importance of Physical Training A in such schools is obvious.

The second division, Physical Training B, requires the introduction into the school day of at least four short recreational setting-up drills. These class drills are expected to interrupt the sedentary sequences of the school program and provide refreshing variety, healthful stimulation, and interesting diversion. These drills are also expected to assist the teacher in improving the posture of the children in the school and to bring about alert response and obedience to command. After such a period, there should be brighter eyes, flushed cheeks, and greater happiness in the schoolroom. Experience has shown that these short drills are followed by better class work.

The third division, Physical Training C, provides for an elaboration after September, 1917, of the present syllabus on physiology and hygiene. The new and larger requirement will call for two ten- or fifteen-minute periods a week, which are to be devoted to instruction concerning the care of the body and the facts of health. This instruction will include such central topics as cleanliness, posture, cheerfulness (care of the emotions), care of the digestion, care of muscles, eyes, ears, nose and throat, teeth, heart and circulation, lungs, and care of the nervous system. In the secondary schools, the central topics will be such as the laws of health, the causes of poor health and disease, the carriers of disease, the contributory causes of poor health, the defences of health, personal hygiene, domestic hygiene, and community hygiene.

The fourth division, Physical Training D, provides for supervised recreation. This division of the general program calls for four recreational hours a week. In the discretion of the local school authorities, three of these hours may be covered through activities outside the school, either in the home or the community. Home gardening, home care of animals, or any other home work involving physical activity and containing a recreational element, may be accepted by the school authorities as substitute equivalents for this requirement in the school; or active membership in some recreational organization within the community may serve the same purpose.

This division of the physical training program contains great possibilities, not only for the better health of school children but also for their greater happiness and better training along lines other than health. The use of play, group dancing, various games, athletic competitions, and so on, makes it possible to give the school child through this division of the general plan the advantage of all we have learned concerning the mental, moral, social, and physical values of play and recreation.

The fifth division, Physical Training E, is devoted to gymnastic drills and marching. At least sixty minutes a week, preferably in two divisions of thirty minutes each, are required. In addition to the health values that may be obtained through gymnastic drills, the school may gain the important benefits that come from training children in group or mass deportment. Such drills, wisely managed, give the school officer a very practical and very useful control over larger numbers of school children who have been trained in mass tactics. The items of alert, obedient response to command are important here just as they are in the recreational setting-up drills.

The syllabus on physical training, a copy of which should be in every school, is developed for the use of the class teacher and the special teacher of physical training who is concerned with meeting the requirements

PREPARING TO PLAY CIRCLE PASS BALL
Township fair, Greig, Lewis County

laid down in the general plan or program outlined. In order that local intelligence and experience may not be unduly limited or restricted, this syllabus is presented to a large extent as a series of suggestions, which the local school authorities may follow or for which they may substitute

lists of exercises devised or selected by them for their local use. If these local detailed programs are approved by the Department of Education, they may be substituted for options that are contained in something like two hundred and fifty pages of the state syllabus.

BASKET BALL ON THE SCHOOL PLAYGROUND
District 1, Town of Scarsdale, Westchester County

It is obvious that the primary object of the state program of physical training is the health education of the school child. The importance of that object does not need emphasis. In addition, this program aims toward the production of happiness, the training of character, experience in social discipline, and respect for law and order — all of which are of prime importance in training for citizenship. If these health habits and these social habits are established in the grades and in the secondary schools, there is no doubt as to their continuation in adult life. It is rational and reasonable to expect that this kind of experience will produce a better type of citizen.

Briefly stated, some of the special features of the state program of physical training are:

First: The amount of time which it demands. The five divisions of the program call for a total of something like six hours a week. The poor success of physical training ordinarily is due to the insufficient amount of time devoted to the physical training program. A program that is to impress itself into the habits of the child must occupy an appreciable part of the daily life of the child. Six hours a week for this kind of activity is little enough.

Second: The state program of physical training emphasizes the importance of the class teacher in the health education of the school child. Important and necessary though supervisors are to the proper conduct of the work, they can never take the place of the regular teacher who has such marked opportunity because of constant association with the children. Sooner or later all teachers in our schools will be trained to meet the ordinary classroom obligations placed on them by the state requirement. As a result, our school children will be more effectively protected, and we shall have a higher degree of health in our school children as well as in our school-teachers.

Third: This program recognizes play as a medium for health training, moral training, and social training. We have known for a great many years that mental, moral, and social training comes best through the right kind of play and the right sort of recreation, but we have been very slow in utilizing play for such purposes in our schools.

Fourth: The state program presents a unique feature in that it recognizes the importance of and encourages the use of home and community recreational projects. If this conception is a practical one, its application should bring the school, the home, and the community into a very much more intimate and cooperative relationship than at present exists. It does not seem impractical or visionary to plan for a relationship that will carry the activity of the school over into the life of the child outside the school, and that will use the outside experiences in the life of the school. As a matter of fact, such a sympathetic bond ought to be the primary and fundamental object of the whole of our public school education.

THE IMPORTANCE OF THE CLASS TEACHER IN THE PHYSICAL TRAINING OF THE SCHOOL CHILD

The most effective period for health education is that of infancy and childhood. Enduring health habits established thus early in life lead to the acquisition and conservation of real health. The most important influences in this period are likely to come from the mother and the school-teacher.

The mother that teaches her child successfully habits of cleanliness, habits of slow eating and thorough chewing, regular habits of excretion, vigorous habits of play and work, habits of happiness, and regular habits of sleep, is doing more for the health of her child than all the rest of the world can ever do at a later time.

Unfortunately, mothers are often not well trained themselves. Unfortunately, the health habits at home are very frequently bad. The mother is commonly too busy to make the best use of the opportunity that infancy offers for the establishment of wise habits of living. And

so the child very often brings to the school-teacher an opportunity for service that is larger, more serious, more important, and more attractive because of the health educational limitations or failures in the home.

The mother is concerned largely with the health habits of the individual child. The teacher is concerned largely with the health habits of a group of children. Home hygiene therefore is more nearly individual hygiene, while hygiene in the school is more nearly community hygiene. The class teacher in the small school, especially in the small rural school, faces problems in health instruction that in many ways are very like those in the home. The class teacher in the city school, and particularly in the congested city school, faces problems that are very like those that the community as a whole faces.

PLAYING BALL
District 4, Town of Middlesex, Yates County

No other member in all society is given the opportunity that comes naturally to the teacher to influence individual and community health habits. The teacher that gives children wise health information, that helps them establish reasonable habits of correction and repair, that influences them to rational habits of health protection (the avoidance of the agents that injure health), and that develops in children good habits of nourishment, excretion, exercise, recreation, happiness, and rest, is the teacher that has made use of precious opportunities, the best of which come only to teachers, and has met an obligation that is too often not recognized.

Such a teacher — and every teacher should be such a teacher—will have better work from her healthier pupils; there will be less absence from class on account of sickness and fewer backward pupils; and there will be fewer funerals from her classroom. Such a teacher must be an important factor in the production of a happier, more useful, and longer-lived community of men and women.

Since health is a basis on which men and women build their greater success, their larger happiness, and their longer mental, moral, and physical productivity, the state program of physical training should stimulate every teacher to greater effort to meet his or her obligation to be in good health and to teach others to acquire and conserve health.

A MESSAGE TO RURAL TEACHERS REGARDING PHYSICAL TRAINING

DANIEL CHASE
Assistant State Inspector for Rural Schools

Rural teachers who read this article already know in a general way the requirements of the New York State physical training program. Most of you have been doing your best to carry out the requirements of that program. Dr. Storey has presented in this leaflet a statement

TWO O' CAT
District 2, Town of Shandaken, Ulster County

regarding the time elements and the subject matter of the syllabus as they will be in effect after September, 1917. Mr. Tuttle has urged me to write a message directly to those who teach in the country schools, to give you something to help you see your personal relation to physical training activity and its relation to the whole program of work for the boys and girls entrusted to your care. It is my desire to talk in an informal, personal way about conditions as they are and as they ought to be. I think of you who read this as my friends. During the past year it has been my very great privilege to meet and talk to over seven thousand rural teachers. Of course I cannot call you all by name, but if you mention the conference at which we became acquainted, I can tell something about what happened there and some of the games we played. Try me!

Before going further we'll stand and take a two-minute drill just to keep the spirit of the work. Class stand! Arms forward, upward, raise! Stretch! Don't forget the good posture, and be sure and take deep breaths, with the windows open! Now we'll go on.

Let me analyze conditions as they are after nearly a year of effort. I am going to talk frankly, but without prejudice, because I believe that

every rural teacher is ready to make an honest effort to do the work well and with spirit during the coming year. At the start let me tell you about some of the good things that have been accomplished, for I have seen and heard of many excellent results. It is always well to look for the good points first.

Dr. Finley in his inspired personal word to you that accompanied the syllabus, called it a program of "health and happiness." He asked you to do your part in translating it into the lives of your pupils, saying that he considered it "worth while as a health program, ... but it is to be worth more as a program of moral discipline and of social and patriotic service." He mentioned in his report to the Regents the fact that this program is for strengthening the physical foundation in which our higher intellectual and spiritual curriculums are to find support. "Health habits will be emphasized. Natural play will be fostered. The educational values of interesting play will be recognized and used. Under this physical training requirement, games and play will serve as attractive sources of educational development, promoting happiness, interest, sharper wits, obedience, correct posture and bearing, alert response, respect for rules, orderly conduct, courtesy, self-restraint, love of fair play and a habit of playing fair, loyalty, honesty, a sense of justice and duty, and a spirit of cooperation under leadership."

You will realize at once that we are a long way from complete realization of the ideal so wonderfully pictured, so fully presented by our Commissioner. Yet a beginning has been made. In thousands of schools the setting-up drills, the exercises for the shoulders, the postural corrective work, the training of the small muscles and the nerve coordinations have had the anticipated effect in bringing about noticeable benefits. I myself have seen them. Teacher after teacher has so reported. Posture tests in one section of northern New York show fifty per cent improvement, and similar reports come from Oneida, Erie, and Nassau Counties. Fewer absences from school and more interest in the other work are general observations.

Health clubs have been used to good advantage in a few rural sections, boys and girls thus being stimulated to aid one another in forming regular habits of brushing their teeth, sleeping in fresh air, and keeping face, hands, and clothing clean. This has taken time and energy on the part of the teacher and the supervisor, but it has been worth while.

But the effect of the organized play and games has been the most remarkable of all. Just think what a change has taken place when children come gladly to school and protest against being made to stay away, as is now the case in many places! One boy in Oneida County said to me, "Why it doesn't seem like school any more. We have such good times. The teacher plays games with us every day." A girl in Nassau

County, daughter of the superintendent, on being kept out of school on account of an infected ear, appealed to me to get her father to let her go back so that she would not miss the physical training.

Teacher after teacher has spoken of the increased efficiency in mental work as a result of the setting-up, or refreshment, drills. One man in the southern tier of counties reported that, because of the drills, he had been able to cover more subject matter in three months than he had covered in previous years in four.

Several of you have spoken of the personal health benefit derived from the new program. One statement regarding the difference in the last recitation period of the day still sticks in my memory. Is this your experience? "Last year the last period used to drag so. I thought it would never end. This year it is snappy and as full of zest as the first. Why? Because of the drill, and because I go out and play with the children at recess."

The most eloquent and inspiring testimony came from a rural teacher who said, "Why it is doing for my school just all you said it would do!" Those of you who know how many claims I have made will understand my appreciation. Yes, those of you who have given the work a fair trial are, for the most part, well pleased and can see results.

On the other hand, there are several classes of rural schools that do not show results:

1. There are a few rural districts that have done nothing at all. The syllabus was new; it looked hard; and it was late in coming out. The district superintendent had failed to require that the trustees provide a physical training supervisor. The teacher, having no real interest and not being pushed on by the superintendent, made no beginning. This is a small group, for most of you have at least made an effort.

2. In the second group some work has been attempted, but no supervisor has been provided. The teachers have tried to give exercises that they have seen given or read about in the syllabus or some other book. But they were given only occasionally, or in a half-hearted way, or, worse yet, incorrectly. These teachers may have been urged to meet the law by their superintendents and perhaps given some instruction at conferences, but they had no regular help from an expert supervisor, and so went ahead as they saw fit, making mistakes by doing too much and too difficult work in some instances, but more often doing too little, and not insisting that what they did do be done correctly.

One of the teachers of this group reported to another, "The hardest work I have in my school is to keep the children sitting absolutely still for two minutes in the 'sitting-up' drill." This is an extreme case, of course, and may have happened before the syllabus was distributed in January. One superintendent that I know did not give out the syllabi

until March 30, and, of course, had provided no physical director to help his teachers up to that time. Therefore in his section it was natural to expect mistakes where teachers were conscientiously trying to carry out the law of the legislature, which said to them, "every student over eight years of age, must have, at least, twenty minutes a day of physical training," or the instruction of the university bulletin, which said, "every teacher must give setting-up exercises for a minimum of two minutes at least four times a day, and see that all pupils have sixty minutes of supervised play and recreation each week."

Some of these teachers, being naturally good teachers, have handled the play requirement in excellent shape, even where they have had no

RECESS
District 1, Town of Van Buren, Onondaga County

supervision nor previous instruction in the theory of play and its values or in the kinds of games adapted to the various groups, ages, and sexes. Some teachers have always used the play instinct in directing the growth of their pupils; so it was not new pedagogy for them to teach play and games in the right way. Others, missing the spirit of the requirement, handled the supervised play as they would any book subject, retaining their usual pedagogical dignity, insisting on quiet, and quelling all natural outbursts of necessary enthusiasm. They made the supervised play period tiresome and distasteful to the children and to themselves. No one came around to show them how to have real play periods, and many of this group had forgotten how; so they did more harm than good. Just think of making a girl or a boy hate play!

3. The third class of schools not up to standard in results last year was that in which supervision was too limited in quantity, that is, spread out too thin, or inferior in quality, that is, poorly trained, inexperienced physical directors were required to serve an entire district. Some had two or three high schools and fifty or sixty rural schools to cover; others had one village school system and forty or fifty rural schools. Some were teaching from four to seven high school subjects and looking after the physical training program in the time left over. Some were doing this and attempting to supervise from six to thirty-one adjacent rural schools in addition.

THREE DEEP
Township fair, Greig, Lewis County

In this group it is the superintendent who must bear the responsibility. I sympathize with him, for I know his problems by this time very thoroughly. But I know that some have not been whole-souled in their efforts to meet the situation. And the fact remains that the boys and girls in the schools of the three classes just mentioned have not had their share of benefit from the new program, and that the untrained and poorly supervised but, on the whole, willing teachers are not all to blame.

4. The fourth group of rural schools below par as to results is that in which the teacher has willfully neglected or refused to do her part.

In this group competent supervisors may have been at work and may have made weekly or fortnightly visits. The children may have learned a good deal from the expert, but because the teacher has failed to carry out the daily exercises as outlined, the lessons were forgotten. It is only practice that makes perfect. It takes years of drill to establish firmly the fundamental mathematical processes in the minds of your pupils. To establish the habits of good posture and the lessons of response and rhythm, you must give the physical training drill daily. You must give it *right*, with exact attention to form and with proper *vigor* and *snap* and *enthusiasm*. Have you read Dr. Storey's suggestions on page 45 of the syllabus?

Most of the teachers who are doing the best work go through the exercises with the children when the supervisor is teaching the new lessons.

A few do not. Some have been making the serious mistake of leaving the room while the new work is being taught. Many take "a vacation" whenever the physical training supervisor appears; some do this gladly, because it gives them "a rest," while others do it reluctantly, because they think their really important school work is being broken into. Such teachers, knowing nothing about the new program, never will know anything because they are not trying to learn. Is it surprising to find these teachers having trouble with discipline? They say it takes so long for the children to get back to work after physical training, and complain about lost time. Not having entered into the mental process of the pupils during the exercises, they cannot control or direct these processes after such work. Mr. Tuttle often talks about "tuning up" your school before teaching. To get out of tune as these teachers are doing seems to me unpardonable.

It is time for another drill. Are you ready? Take a few stretching exercises! Yes, yawn, if you must! Open the windows! Wide! Play a good, lively game, or drop some curtsies and hop and skip a little. Now, some deep breathing! Finish with marching. All together: left, right. Be seated.

Now we are ready to read again. The exercise makes us more efficient. We can work faster, we are more alert, and we respond better. The restlessness is gone. Our surplus energy is cared for, and we sit a little straighter and hold our heads much higher than before. But that is not all we do when we lead a drill or have a play period with our pupils. The rest will be clear as we go on.

DROP THE HANDKERCHIEF
District 4, Town of Bath, Steuben County

Let me say an earnest word to all of you. Do you see the significance of the pictures I have drawn? If so, you can understand that in all our rural schools the regular teacher is the most important factor in determining the amount of good the boys and girls are to receive from physical training. No matter how many expert supervisors may be provided, your attitude is the thing that counts most.

The first duty of the supervisor is to help you to understand and to apply the syllabus, and it is your duty to get all the help you can and to use it for the welfare of your pupils — mental and moral welfare as well as physical remember, for we cannot separate the elements of a child's make-up into distinct parts and work on one without affecting the others. When we touch one, we influence all. Dr. Arthur Dean, former head of the Division of Agricultural and Industrial Education, whom I consulted, advised me to make the central theme of this article the use of physical training work as an aid to and an integral part of the entire process of the school program.

The game, the play period, is more than a means to an end. It is an end in itself. Play is education. Do not lose sight of that. What are you trying to do as you teach school? Drive your boys and girls through so many books or subjects? Not if you are a real teacher. You are assisting the boys and girls to develop character. You are building men and women, training thinking beings fit to be the future citizens of a democracy. In the school you are teaching the child how to adjust himself to social conditions. You are encouraging and directing his growth. Play is growth. As Joseph Lee says in his wonderful book *Play in Education*, " Play is the very act and throe of growth. It is the essential part of education, nature's prescribed course."

Perhaps you are saying, " Oh, we know the rest, fine sounding phrases about the value of play in developing morals, teaching power to cooperate, building up sociability and power of agreeableness, and the like! We have heard them so many times." I know that you have had the theory of all this reiterated in training class and normal school, in educational meetings, and in publications. My only excuse for mentioning it is that I am afraid some of you do not believe in it yet. Miss McCloskey, who, as first editor of this leaflet, did so much for rural schools, and whose memory is revered by every one who knew her, used to write about it. Seven years ago she wrote something that you ought to be quoting to your boys and girls very often until the lesson sinks home, and to the girls oftener than to the boys. For, though you may not have noticed it in your school, in most schools the girls have a lower standard of sportsmanship than the boys. The article to which I refer by Miss McCloskey was one of her *Fireside Talks* on honesty. It was reprinted in the November, 1916, Cornell Rural School Leaflet. Let me quote the most significant paragraph:

> **Play every game straight. It does not matter if some one should beat you in any sport. Take it good-naturedly and try again to win. If you play the game honestly and are a good loser, you will be taking a step in the right direction to do some greater things well. If your comrade in play should be dishonest, it is no excuse for you to be the same. It will help him much to see your honesty.**

Miss McCloskey knew the value of play in education. In her article on unselfishness, republished January, 1917, she also gave something for you to think about and to use. In speaking to children she says, " Did you ask some timid pupil in the school to play with you although you

PHOTOGRAPH BY VERNE MORTON

POM-POM-PULLAWAY

felt that the game would be more interesting without him? Did you try to control laughter when you knew that it was going to hurt some one else? " How clearly she was teaching us to use the natural play interest. Drive home these fundamental lessons. Play is the real life of the young child. It is his most serious business. You are expected in 1917–1918 to see that all your boys and girls have at least four hours a week of directed play. Dr. Storey has told you the details of the new requirement. Read his article with care.

Most of you already believe in the value of physical training and want to see that your pupils get the full benefit, but you are wondering how to accomplish it. You say, " Shall we be required to lengthen the school day? " In some sections you will, but not many rural sections can. " Shall we leave out some of the subjects now taught? " The Regents have not provided for this and need not, but they may allow Regents' counts for the physical training and play work. This would help.

Some of the ways to meet the new time requirement will be by (1) longer supervised recess periods, (2) organized school hikes, (3) nature study trips, (4) clubs, such as Pioneers and Camp Fire girls, (5) home project work, and (6) other home activities. This last is the big thing after all — cooperation with the parents in seeing that the child has a

chance to develop or educate himself through normal natural ways in play, and to link up the home with the school in the common work of safeguarding his health and happiness. Read pages 195 and 196 of the physical training syllabus.

The attitude of parents toward the school is of vital importance. It is so important that I came near discussing a fifth group of schools. I know that this year the open hostility of parents and trustees in some districts has completely short-circuited the current of good that was generated by a conscientious teacher and a competent supervisor. This made it impossible to get a normal reaction in the boys and girls. Some parents encouraged children in refusing to take the exercises; some obtained medical certificates, without just cause, to get their children excused. These latter cases were not numerous, and nearly all have been brought into line where a competent physical director has been at work, backed by a loyal superintendent. But some remain. Many of these have pooh-poohed the idea that country children need to be taught to play. Many have said that it was nonsense to say that you teachers needed help from experts in understanding the syllabus or in learning to properly give the exercises. This type of school can only be helped by converting the parents and trustees. This is gradually being done where teachers are showing results. The people are discovering that physical training is not physical straining as I have said so many times. They are getting gradually a new vision of the importance of play in the life of the child. The part organized recreation may have in conserving the finer things of community life is now to be studied, and what it can do to aid in rebuilding a healthy social life and to benefit the economic and spiritual factors of country life is beyond conception. It will be your duty and privilege, teachers, to help educate parents to the new requirement. I say privilege because it will be a rare one if you handle it right. You have the chance to show the practical interest the school has in every pupil as to that most precious of all possessions, health.

I suggest that every rural school-teacher keep a record of every pupil. Discover, by sending out letters to all parents, what the home activities of the boy or the girl may be, also the distance to school, out-of-school organizations attended, and the like. Then tell the parent what work is being done at home that will be considered by you and the physical training supervisor as an equivalent to part of the required physical training. Solicit the assistance of the parents in seeing that the child performs his home duties, and request frequent reports.

If it is plain that the child is getting too much and too hard work at home, here is a splendid chance to teach the need of play and systematic exercise. School credit is given for what is done at home; therefore you have a right to offer advice and to make suggestions. Use your oppor-

tunity to teach practical hygiene and health habits. It cannot be considered as intrusion into what is none of your business. It is now distinctly your business to take an interest in the homes of your pupils. The school nurse will be needed more than ever to supplement the work you will be doing. Some of the physical training supervisors are helping now with this follow-up work, and will help you more next year.

If this written talk serves to help any rural teacher to take hold of the physical training program with more interest, zeal, and spirit than before, or if it encourages some of you to continue the fight with increased vigor, I shall be fully repaid. The members of the Physical Training Bureau of the State Military Training Commission are heart and soul in this work for the welfare of the boys and girls in the schools of the State. By birth, training, and assignment I happen to be especially interested in the rural child.

We all need the courage that comes from standing together in a good cause. We need to feel that our efforts are understood and appreciated. Then we are inspired to do our best. This thought is expressed in the following poem with which I should like to close:

VITAÏ LAMPADA

HENRY NEWBOLT

There's a breathless hush in the Close to-night —
  Ten to make and the match to win —
A bumping pitch and a blinding light,
  An hour to play and the last man in.
And it's not for the sake of a ribboned coat,
  Or the selfish hope of a season's fame,
But his Captain's hand on his shoulder smote —
  "Play up! play up! and play the game!"

The sand of the desert is sodden red —
  Red with the wreck of a square that broke;—
The Gatling's jammed and the Colonel dead,
  And the regiment blind with dust and smoke.
The river of death has brimmed his banks,
  And England's far and Honour a name,
But the voice of a schoolboy rallies the ranks:
  "Play up! play up! and play the game!"

This is the word that year by year,
  While in her place the School is set,
Every one of her sons must hear,
  And none that hears it dare forget.
This they all with a joyful mind
  Bear through life like a torch in flame,
And falling fling to the host behind —
  "Play up! play up! and play the game!"

CHILDREN'S GARDENS

THE EDITOR

A VERY marked development in garden work for children has been witnessed during the past season, growing out of the general concentration of attention on food production and conservation. The movement is one that presents many opportunities and many dangers.

Children's gardens should function primarily as a factor in education, and the chief guiding motive should be that of the growth coming to the child through contact with the soil and plant life. This should never be lost sight of in the desire to produce a few more fruits or vegetables. For this reason it is of tremendous importance that any movements started for the development of children's gardens should be under the direction and guidance of educational authorities. Only in this way can the work be safeguarded.

Naturally there are numerous agencies interested in food production and conservation that would be glad to avail themselves of the publicity and the popularity arising from the employment of children. The aid that such agencies may render should be recognized and used wherever possible, but always through the educational authorities.

The value of gardening for children is no less in times of peace than in times of war, although years of effort have been expended heretofore with much less recognition than has been accorded to the subject in the last few months. The wave of popular interest offers an opportunity to begin the work in many places, and it remains to make sure that its direction falls into the hands of those who have vision for the future and whose interest is primarily in the child.

There are many different types of gardens varying with conditions. Best of all, perhaps, is the garden that the child has at home, in the working of which he is inspired and guided by the school. Home gardens may be developed both in cities and in country districts.

The general garden at school in rural districts should assume the character of an experimental or demonstration garden, teaching principles

that are to be applied at home and a recognition of forms of plant life that are perhaps not widely known.

In cities it is often necessary for a group garden to act as a substitute for the home garden, when children do not have ground available at home. In such a case a large piece of ground, adjacent to the school if possible or in some centrally located position, is used by a large number of the children under competent direction. Of all types of children's gardens, this probably involves the most difficult problems, but, in some respects, offers unique opportunities.

The material presented by Miss McCloskey was written a number of years ago and grew out of her experience with children's garden work in Ithaca and a wide study of conditions in various places in the eastern United States. It is full of suggestions many of which are not to be found in the usual discussions of school gardening.

GARDENING WITH CHILDREN

Alice Gertrude McCloskey
Founder and late Editor of the Cornell Rural School Leaflet

Gardening is now recognized as having much educational value. A child properly trained in gardening gains knowledge of natural forces in the most direct way. He forms habits of industry, learns patience and perseverance, learns to meet adversity, develops his reasoning powers, spends hours with useful and beautiful things, has physical exercise under ideal conditions, and at the same time is laying the foundation for delightful and wholesome recreation in later life.

The time is coming when there will be in every live community a playground, a children's garden, and a model kitchen. The gardens will be under the direction of a trained horticulturist, a man of personality who will direct the children in growing plants under the best possible conditions. There will be also a market place conducted largely by the children under an able director, in which will be sold vegetables, flowers, small fruits, and the like, grown in the public gardens. Such institutions will provide occupation for children during the vacation time, giving them opportunity for work and play, as well as practical preparation for life.

But this day in many places is not yet come. In the meantime, teachers, realizing the importance of school gardening, can gradually help in this movement by making gardening a part of the school work. If there is not a large piece of ground for a school garden, a little corner can be found in which the class will be able to plant a few seeds and perhaps harvest a small crop before the close of the school year. Seeds are wonderful in themselves. The miracle of a poppy would alone be a lesson

worth the while. Let the child realize the wonder of a radish plant coming from the small seed that is put into the earth.

I wish that every teacher might be with me once by day and once by night in a garden that I know and love. The practical side of gardening is

A HOME GARDEN, ALBANY, NEW YORK

distinctly important and of itself would be worth while in the education of a child; but when we realize the spiritual development that can come through the love of growing plants, we find our responsibility in putting this development into as many lives as possible. In my garden I do not know which hour of the day is most rich and developing, the hour in early morning, at high noon, at twilight, or by moonlight. Poppies you will find there by hundreds — shirley poppies in all their marvelous coloring of pink and white, California poppies with the rich yellow and green; hundreds of sprays of gypsophila, the spirit flower of the gardens; very much crimson phlox; pansies; forget-me-nots; nasturtiums; bachelor's-buttons; petunias, deep, rich purple petunias; love-in-the-mist; and many, many others. Having grown these plants and watched them with real response to their individuality and beauty, one hungers for the time to come each year when they will again blossom. Encourage every little child you know to have a garden and to grow both vegetables and flowers, shrubs and trees, wayside and wood plants.

SCHOOL GARDENS

A number of persons have failed with school gardens largely because they did not give sufficient thought and preparation to the work. Some enthusiasts undertook the enterprise because it was a new feature in education, and was more or less interesting to the public. But when there was realization of the labor necessary to keep a piece of ground in cultivation, and the amount of effort needed in the beginning to keep the children interested, there was not enough enthusiasm left to investigate the cause of the difficulties, and overcome them.

Very often too much is attempted the first year. Some very attractive school-gardening work has been done on large pieces of ground with hundreds of children. The persons who have made a success of this work have had deep belief in its value, and have given much perseverance and time to developing the enterprise. Noting their success, many teachers have endeavored to do likewise. They have had the children cultivate some large piece of ground, difficult perhaps to work, and failure followed. It were far better to make very small beginnings, teaching children to cultivate a few plants well, than to have them undertake too much with-

CHILDREN'S GARDEN
Public School 52, New York City

out knowledge or energy to complete what they have begun. Let the first efforts be very simple.

But make a beginning. Whatever the hardships it is worth the while, if for no other reason than to give the children the resource that love of

gardening brings into their lives. Do you think that gardening is a wholesome and healthful thing for little children, for their bodies and their minds? If so, give the young persons in your community, whether in the country or the city, this opportunity for development. Do not be discouraged if those who sit by the wayside question your success. Some persons will expect to see the children carrying baskets of flowers to the hospitals at the end of the first year; they will expect the garden to be a thing of beauty, free from weeds. Do not be discouraged if you cannot accomplish all this. If a fair start is made in the first year, time will bring about desired results. Each year the work will grow stronger; each year the garden can be more profitably cultivated; each year the children's love of the soil and the green things growing will increase.

Let us first consider a school garden under favorable conditions. There is a piece of ground, a half-acre, perhaps, in extent, not far from the school. This ground is at the service of the teacher and the children. The problem before them is to make it a productive piece of property, to give the greatest educational value possible per square foot. The proper handling of this work should bring about definite educational and social development for the children. The following are some of the factors that should be considered in this development:

1. *Civic pride.*— Every citizen should consider what part he can take in making his city more attractive and more desirable in every way. Children should begin to think of these things. Before the piece of ground is touched, they should be given an opportunity to discuss the condition of the property and make suggestions for its improvement. The school garden should be one of the most marked demonstrations of civic betterment.

2. *Order.*— A school garden should be an expression of orderly arrangement. If the children are very young, the ground should be prepared and staked before they begin work. With older boys and girls, however, it is well to let them do everything possible in connection with the development of the grounds. Give the children everything that you can to make the ground look orderly: the stakes should be the same size, twine the same quality and color, measuring lines the same, and the like. In a garden connected with a settlement, I was told that the children cut the strings separating the plats, that they pulled up the stakes, and were generally destructive. I looked over the piece of ground, and was not surprised that this had taken place. The stakes were made of any available piece of wood that could be picked up, and the plats outlined by strings differing in kind and color, so that the appearance of the place was not such as to demand respect. As soon as the ground was properly laid out, the children had an appreciation of its neat, orderly appearance, and there was no further destruction.

3. *Landscape design.*— It is not sufficient that a plat of ground should be neat and planned for utility. It should be developed along the lines of good landscape design. Any teacher who has this proposition before her should, if possible, consult a landscape gardener in regard to her plans. It is much better to have the garden properly laid out in the beginning than to try to make changes after its development has begun. The plan of the grounds, the situation of tool house, pond, and the like, and the planting in the garden, should be decided before the ground is touched. The older children will receive valuable lessons in drawing up the plans

FAIRVIEW SCHOOL GARDEN, YONKERS, NEW YORK

and locating the different features that will make the grounds more useful and attractive. They should make maps of their own plats, marking the kinds of plants to be grown, distances between rows, and the like.

4. *Architectural features.*— Every school garden should have a tool house. There should be a shelter. There should be some sort of entrance to the grounds marked by a signpost or an archway. These architectural features should not be put up in a hit-or-miss fashion. Any architect in the community would be willing to suggest plain structures that have good architectural lines. Such features will be educative, since the children must see them every day.

5. *Planting.*— From the very first the children should be consulted regarding the planting of the school garden. They should feel that with patience and perseverance this piece of ground can within a few years be made a thing of beauty and civic pride. The school garden should be a place in which children will become familiar with plants that they will later grow in their own home gardens.

6. *Life.*— The school garden affords the best opportunity for general nature study. Here the children come into contact with plant and animal life, both beneficial and injurious in connection with the garden. They should be given some knowledge of insect life, that they may be ready to make observations as the season advances.

7. *Inquiry, accuracy, patience, perseverance, and courage in times of adversity* may all be developed in a school garden. The most should be made of this opportunity to strengthen these qualities in children.

8. *Result of labor.*— Careful work is rewarded. In the school garden at Ithaca this point was very clearly demonstrated to the children in many ways, but one in particular comes to my mind. The tomato plants that were used in the gardens had been grown in individual pots. The children made selections for their gardens from several hundred plants, and were taught which were most likely to grow into productive plants. They were cautioned to put the plants into the ground in the most careful way, not interfering with the root system any more than was necessary, and firming the ground well about the plants. They followed directions carefully. A few days later there was a severe frost that killed many plants in the neighborhood. The children lost but twelve out of the four hundred, probably because of the strength of the plants and the care with which they were set out.

9. *Thoughtfulness for neighbors.*— Oftentimes children are antagonistic toward one another largely because thay have had no one to help them to a better point of view. With the right direction, it is not difficult to have them develop a sense of justice. In the school garden there is ample opportunity to learn that carelessness in respect to their own property may cause their neighbor inconvenience.

10. *Generosity.*— A talk with the children as to what they will do with their crops will often suggest to them some pleasure they can give to others. This should be encouraged. I have known children who took more delight in giving away flowers and vegetables than in keeping them. All children are imitative, and in a community such as a school garden one generous spirit often encourages a like spirit in others.

11. *Entertainment.*— If the teacher in charge of the school garden will help the children give a reception on the grounds, at which they can entertain their parents and friends, it will be valuable in many ways.

In preparation for such a function, teachers will have an opportunity to give instruction in some social forms that will be helpful to the children in future life.

SOME THINGS TO CONSIDER IN CONDUCTING SCHOOL GARDENS

1. *Organization.*— A good-sized garden for children must be well organized. Everything should be worked out carefully before the time of planting, since confusion defeats the purpose and progress of the work. In handling large numbers, time should be taken for drill in the discipline of the garden. This will be very helpful through the entire season. Teachers will find that a whistle will save their voices. This can be used as a signal, the children learning the meaning of the different number of times it is blown. Obedience is much more easily obtained out-of-doors than in the schoolroom. The children are more cheerful and seem willing to conform to all that is necessary to make the garden a success.

2. *Size of plats.*— In staking out the ground, do not make the plats too large. Children become discouraged if they have more to do than they can do well. I have found that a plat 8 x 10 feet occupies all the time that the average schoolboy of ten or twelve years cares to give to gardening. If, however, the child takes the plat to make some money, he may be successful in cultivating a larger piece of ground.

3. *Class garden.*— Satisfactory results have been obtained by having the entire class take charge of a piece of ground, each having a share in planting a row or part of a row. The children work together, and the harvest is used for any purpose that the children as a class desire. In this way a small piece of ground can be used for a large number of children.

4. *Tools.*— The tools should be ordered early in the season. We have found in our gardens, that for most work the small-sized hoes and rakes of good quality have been more satisfactory than large ones. The children can handle them more easily, and in the close culture of small plats they are more convenient. At the close of every exercise tools should be cleaned and hung in the tool house.

5. *Testing seeds.*— Children should learn to test seeds that they buy.

6. *Market.*— The handling of produce opens a large and interesting field in education. If children wish to sell their products, they should learn that it is always important for the market gardener to present his produce to the public in the most attractive form. Some children make during the winter the baskets in which they are to exhibit their garden products. Some day there may be market places in villages and cities for the crops grown in children's gardens. This would add greatly to the interest the children would take in their harvests. Such an enterprise would encourage industry and appeal to many idle boys.

7. *Wild gardens.*— In some schools the children have very interesting wild gardens. A piece of ground has been selected for this purpose, the soil enriched with earth from the wood, and as the years pass the children have added to the number of wild plants. Wood plants should not be transplanted while in blossom. If the teacher will take her pupils to the woods some day in spring and mark the wild plants by means of a piece of wood strong enough to resist the storms of spring and summer, the children may dig up the soil in this place and in the fall the root of the wild

RURAL SCHOOL GARDEN
District 7, Town of Batavia, Genesee County

plant may be obtained. One school in this State is trying to have specimens of all the wild flora in the vicinity. The children should always be cautioned against exterminating wild flowers.

8. *Old-fashioned flowers.*— The children enjoy laying aside a small piece of ground for a grandmother's garden, which will include ice plant, marigold, portulaca, catchfly, four-o'clock, mignonette, bachelor's-button, and many others.

9. *Observational plats.*— Many children in villages and cities do not know how the common grains look in the field. It is a good practice to have observational plats in the school garden, growing grains and some

of the more important economic plants that are used in some form by nearly all persons. In a school garden in Chautauqua three kinds of oats, differing in quality, were grown, and the children had opportunity to observe the value of selected seed. This gave opportunity for discussion of plant breeding.

10. *Borders.*— Some place in the school garden should be chosen for an attractive walk, flower-bordered on either side. In the garden at Ithaca the entire grounds were flower-bordered. The entrance, marked by a signpost, led along a path eight feet wide and seventy feet long used as an approach to the tool house and assembly arbor. This path had a border on each side in which were grown the following: nasturtiums, bachelor's buttons, marigolds, zinnias, larkspur, and sunflowers. The lowest-growing flowers, the dwarf nasturtiums, were planted near the walk, the other flowers grading in height up to the sunflowers. All of these plants were easily grown, and furnished flowers throughout the season.

11. *Shrubs.*— The first year the children should discuss at least one shrub. Children like a touch of color, particularly red. I would suggest, therefore, that each school try to obtain a crimson rambler rose, which may be bought from any nurseryman. This would give a bit of cheery color.

12. *Arrangement of flowers.*— To arrange flowers artistically is a study in itself. A person of good taste is frequently annoyed on entering a home to note the way in which the flowers are placed in vases. Any person who has the management of a school garden should get as much information as possible in regard to arranging flowers. Combinations of flowers should be taught. Some cut flowers look best by themselves, while the beauty of others is increased tenfold by combining with some other blossoms or bit of green. Have you ever arranged sweet peas with gypsophila (baby's breath)? Have you ever taken the black-eyed susans from the field and arranged them in a bowl with the common sensitive fern? Have you ever arranged red poppies with oats?

13. *Sundial.*—Sunshine and shadow give material for many nature study lessons. Sunlight has to do with gardens. The sundial offers outdoor interest and would be desirable in the school yard.

RURAL SCHOOL GARDENS

Many of the principles given in the preceding paragraphs will apply to rural conditions, but the rural school garden will have a character all its own. It will be, in a way, a small experiment station, a place in which investigation of problems interesting to the farm community in which it stands can be conducted by the pupils. These problems will vary in different localities. The rural school teacher should inquire what is being

grown on the farm lands, and with the aid of her pupils endeavor to add to the knowledge concerning these crops. She should keep in touch with departments of agriculture and current literature along these lines. She should encourage pupils to conduct experiments so that they may find out for themselves some things that will improve the farm crops. If I were teaching in a rural school I should discuss with the children ways in which we might use some of the common field plants for decorative purposes. Clovers, daisies, buttercups, black-eyed susans, goldenrods, asters, ferns, wild lupine, timothy, wheat, and the like might be used for borders, and from these one would be able to gather good combinations for arrangement in vases for the home and the school. Field plants are aggressive, but they can be controlled by removing the seeds.

HOME GARDENS

The public garden, whether on school grounds or on vacant lots or in parks, should be the place in which children receive instruction in the growing of plants, that their knowledge may be used on the home grounds. In the school garden should be grown types of shrubbery and flowering plants, as well as vegetables, that children may learn something of them. They will then be able to utilize their knowledge wherever they may be in after years.

Encourage children to have gardens at home if possible. There they should plant the things they want to grow, vegetables, flowers, vines, shrubs, or trees. With very little effort a teacher will be able to get the children interested in growing at least one or two things the first year.

A HOME GARDEN

THE IMPROVEMENT OF SCHOOL GROUNDS

THE EDITOR

Last spring it was my good fortune to visit the school shown in the illustration on this page. It was an inspiration to look at the place from the highway and lake front. There passed through my mind memories of countless rural school properties, tiny, barren, bleak, cheerless. Yet

DISTRICT 9, TOWN OF CANANDAIGUA, ONTARIO COUNTY

with a little thought and effort, a little time, and a little money, any one of these could be changed and beautified a hundredfold.

Those teachers who were in the work five years ago will recall the discussion of the improvements at District 9, Town of Canandaigua, Ontario County, which appeared in the September 1912 leaflet. Unfortunately there is not room to repeat any of the story here, but the beginning made has not been allowed to fall into neglect. Continued care is given to these grounds, and the forces of nature have worked steadily so that each year the shrubs and the trees are larger, more vigorous, more symmetrical, more beautiful.

The improvement of school grounds is directly related to the celebration of Arbor Day. If the efforts that are made year after year at a given school were to follow some general plan of development it would not be long before results would become apparent. There are only a very few principles to keep in mind in landscape planting, but they are tremendously vital, and if they are violated the result is chaos. Professor Curtis

has presented these principles in the following article, has illustrated them with a plan for an actual rural school property, and has given lists of vines, shrubs, and perennial flowers suited to school ground conditions. This material should serve to present right standards, and to aid teachers and communities that have a desire to make more inspiring and beautiful the surroundings of the place where children spend so much of their time. Careful reading of this article is urged, and we should like to hear from any school where the improvement of grounds is planned or is in progress.

HOW TO MAKE SCHOOL GROUNDS ATTRACTIVE

RALPH W. CURTIS
Professor of Landscape Art

Recall any attractive school that you know and you will find that it has one or more of the following essentials: (1) simplicity and neatness; (2) a natural background; (3) framework and enclosure; (4) a touch of skill and loving care shown by such things as bright flowers in the window, spring bulbs along the sunny foundations, or an attractive vine over the doorway.

Simplicity depends on good order or arrangement and is maintained by neatness. A schoolroom in good order is simple and efficient, and it becomes attractive for that reason alone. Likewise a school yard is attractive when it is arranged simply and maintained neatly. The simpler it is, that is, the better it meets the needs of those who use it, the easier it is kept neat and clean. The walk from the road to the schoolhouse should be direct and not too long. In other words, the building should be near the highway rather than in the middle of the lot. This also gives more room for the play field, which is the most important part of the grounds, but usually not the most attractive. Therefore the play field is better at the side or the back, where it will be unbroken by sidewalk lines, and where it will not interfere with maintaining a good grass space in front of the building to serve as a foreground for the schoolhouse, which is the center of the picture as seen from the highway.

If a driveway is needed either for convenience in stormy weather or for drawing in coal or wood, it should be as direct as possible and yet not more noticeable than necessary. The coal bin in the cellar or the woodshed outside should be located with this easy driveway in mind. Sometimes a gravel road and sidewalk may be combined so as to connect the building with the highway by a simple curve like a half circle or wider as the case may be, thus giving continuous circulation for teams and also direct passage for the children either up or down the road.

Any one familiar with the country schools of the State knows how attractive many of these schools are, nestled at the foot of a hill with the sheltering woods rising behind. Often pine and hemlock are mingled with the foliage of beech, oak, and maple, making a wonderful background for the little white school by the road. Other schools less fortunate are still sheltered by the maple grove wisely planted by the early school fathers, but many more have nothing at all, not even a friendly bush. Bare and weather-beaten they just rise out of the ground. Is it any wonder that children do not love to go to school amid such surroundings?

If your school is of the less fortunate maple grove type, you still have much to be thankful for. Zealously guard the trees that rise at the back and the sides, thinning out only enough to open up a view of the school from the highway and to let in air and light, so that shrubs and flowers will grow about the building. The school will then have the background and the wind protection that it needs and also the framework and shade that make the school building a picture nestled among the trees.

Concerning this matter of framework and enclosure it should be appreciated that a school ground, like a playground or a park, is intended primarily for those who see it from the inside, rather than for those outside. The school ground is for the benefit of the school children, not of the property owner across the way. For this reason we should plan to give the whole school ground some framework and enclosure by planting all the boundaries practically solid except where a good view or outlook would be blocked, and except the public area directly in front of the school building. It may not be possible to do all this solid boundary planting at once, but at least the outlines of the school ground should be indicated by some shrub or tree groups at the corners and also at one or two points along the sides. The back property line is usually fairly well marked either by the natural background of hill or wood or by the trees planted for that purpose in the rear of the schoolhouse.

The front area is all that is conceded to the public. This should be left open and maintained as attractively as possible with smooth grass surface, neat walk or driveway, and permanent framework of shade trees at the sides and shrub groups to soften the corners of the building, to fill in the angle at the steps, to mark the entrance of walk or drive into the grounds, and to indicate the front corners of the school yard. The school children and the passer-by will then get a glimpse of a school building that will be remembered. It will be an attractive picture because the foreground is kept open and low and in good lawn surface, the walk or driveway lines are simple and direct, and the building has a satisfactory background and framework.

The following plants are suitable for use in school grounds in New York State. As a general rule all gaudy types are omitted, and only those normal vines and shrubs are mentioned that have good foliage and good form. They may have also good flowers, attractive fruits, or bright autumn color, but the main thing is satisfactory foliage and good sturdy habit of growth.

VINES

Ampelopsis quinquefolia (Five-leaved Ivy, Virginia Creeper, or Woodbine). This is the first vine to color in the fall.

Ampelopsis veitchii (Boston Ivy). Best vine for brick and stone.

Clematis paniculata (Japanese Clematis). Finest fall-blooming vine.

Lonicera halliana (Hall's Honeysuckle). Somewhat tender in exposed places, but rapid grower with foliage green until Christmas.

Wisteria chinensis (Wistaria). Probably the most satisfactory of all vines, a heavy, vigorous twiner with lavender flowers in early June and graceful foliage all summer.

SHRUBS

Small (3 to 5 feet high)

Berberis thunbergii (Japanese Barberry). Excellent for small hedges.

Deutzia gracilis.

Ligustrum regelianum (Regel's Privet). A hardy privet, much more satisfactory than the tender California privet.

Pinus mughus (Mugho Pine). A shrubby mountain pine, the hardiest small evergreen.

Rhus canadensis (Dwarf, or Fragrant, Sumac).

Rosa setigera (Prairie, or Michigan, Rose).

Rosa spinosissima (Scotch Rose).

Rosa rugosa (Japanese Rose).

Spiræa thunbergii. The twigs often winterkill at the tips, but the plant is very graceful with small white flowers and light airy foliage.

Symphoricarpos racemosus (Snowberry).

Symphoricarpos vulgaris (Coralberry).

Viburnum acerifolium (Maple-leaved Viburnum). A native woodland shrub, excellent in shade.

Medium (6 to 8 feet high)

Aralia pentaphylla (Five-leaved Aralia).

Berberis vulgaris (Common Barberry).

Diervilla florida (Weigela).

Evonymus alata (Winged Evonymus).

Forsythia suspensa (Goldenbell).

Ilex verticillata (Winterberry).

Kalmia latifolia (Mountain Laurel). The finest broad-leaved evergreen shrub.
Rhodotypos kerrioides (White Kerria).
Sambucus canadensis (Black Elderberry).
Spiræa prunifolia (Bridal Wreath).
Spiræa vanhouttei (Vanhoutte's Spiræa).
Viburnum dentatum (Arrowwood).

Large (**12 to 15 feet high**)
Benzoin æstivale (Spicebush). Grows in moist soil just as alders, willows, and the like.
Cornus florida (Flowering Dogwood).
Cratægus punctata (Common Field Thorn).
Hamamelis virginiana (Witch-hazel).
Juniperis virginiana (Red Cedar). Narrow and upright, will become thirty feet high, but is slow growing and easily restrained. Often used for hedges.
Lonicera tatarica (Tartarian Honeysuckle). Best of the bush honeysuckles.
Philadelphus coronarius (Syringa, or Mock Orange). Eight to ten feet.
Rhamnus cathartica (Buckthorn). Excellent hedge plant, very tough and hardy, and stands shade.
Rhus typhina (Staghorn Sumac). Good in poor soil, in solid clumps at a distance. Fiery autumn color.
Thuja occidentalis (Arbor Vitæ). A conical evergreen, slow growing like red cedar, and easily restrained. Common hedge plant.
Viburnum lentago (Nannyberry).
Viburnum opulus (High Bush Cranberry). Bright red berries all winter. Care should be taken to get the American form which is better than the European form, for it is usually brighter both in autumn color and in winter berries.

PERENNIAL FLOWERS

A few bulbs, such as crocuses, scillas, daffodils (*Narcissus pseudonarcissus*), and early tulips, may be planted along the foundation wall or in front of shrub groups. These will give attractive flowers early in May. In other open places, more flowers may be had for May and June and for September and October by planting such good herbaceous perennials as the following:

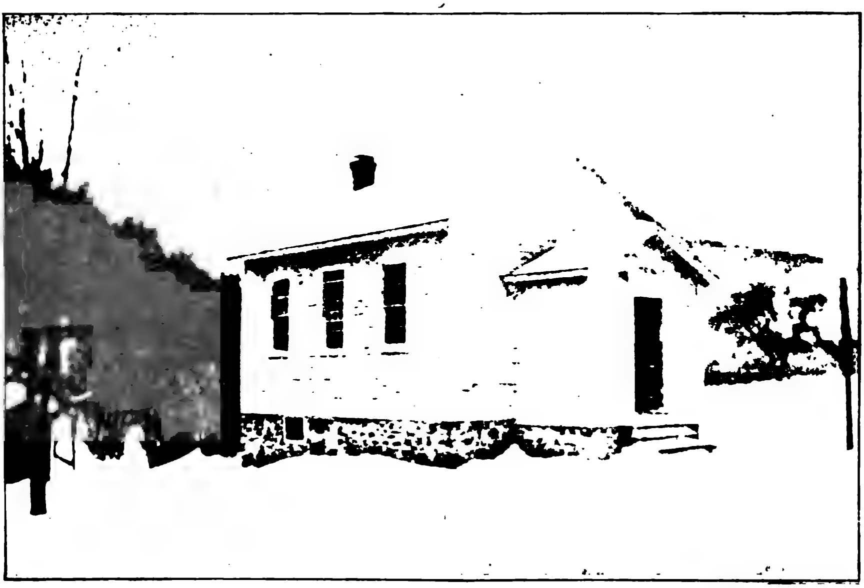
In sun (south of schoolhouse)

Low	Bloom	Season	Height
Phlox subulata (Moss Pink)	Pink	April to May	4 to 6 inches
Alyssum saxatile (Golden Tuft)	Yellow	April to May	12 inches
Trollius europaeus (Globeflower)	Yellow	May to June	12 to 18 inches
Iberis sempervirens (Hardy Candytuft)	White	May to June	12 inches
Dianthus barbatus (Sweet William)	Various	June to July	15 inches

Medium	Bloom	Season	Height
Iris germanica (German Iris)	Various	May	18 to 24 inches
Aquilegia coerulea (Blue Columbine)	Blue	May to June	12 inches
Pæonia (Peonies)	All colors	May to June	2 to 3 feet
Achillea ptarmica (The Pearl variety)	White	June to September	18 to 24 inches
Anthemis kelwayi (Golden Marguerita)	Golden yellow.	June to September	2 to 3 feet
Gaillardia aristata (Hardy Gaillardia)	Yellow with orange center	June to October	2 feet
Phlox paniculata=[*P. decussata*] (Late Phlox)	Many colors	July to September	3 to 4 feet
Gladiolus	Various	August to September	2 to 3 feet
Anemone japonica (Japanese Anemone)	White to rosy pink	September to October	3 feet
Aster lævis (Smooth Aster)	Light blue	September to October	3 to 4 feet
Chrysanthemum (Hardy Pompon type)	All colors except blue and purple	September to November	2 to 3 feet
High			
Aster novæ-angliæ (New England Aster)	Rosy purple	August to September	4 to 6 feet
Helenium autumnale	Yellow	August to September	4 to 6 feet
Boltonia asteroides	White to lavender	September to October	5 to 8 feet

In shade (north side of schoolhouse)

Low	Bloom	Season	Height
Anemone ranunculoides (Yellow Anemone)	Yellow	April to May	9 inches
Vinca minor (Myrtle or Periwinkle). Excellent evergreen for ground cover or edging	Blue	April to May	6 inches
Hepatica triloba (Common Hepatica)	White to pink.	April to May	4 to 6 inches
Polypodium vulgare (Common Polypody Fern)			6 inches
Adiantum pedatum (Maidenhair Fern)			12 inches
Trillium grandiflorum (Trillium)	White	May	12 inches
Convallaria majalis (Lily of the Valley)	White	May to June	8 inches
Viola cornuta (Tufted Pansy)	White, yellow, blue varieties.	October	8 inches
Medium			
Aquilegia canadensis (Columbine)	Red and yellow	May to June	18 inches
Mertensia virginica (Bluebells)	Blue	May to June	18 inches
Onoclea sensibilis (Sensitive Fern)			18 inches
Solidago cæsia (Blue-stemmed Goldenrod).	Yellow	August to September	1½ to 2 feet
High			
Platycodon grandiflorum (Balloonflower)	Blue	July to September	3 to 4 feet
Platycodon grandiflorum album (White Bellflower)	White	July to September	3 to 4 feet
Rudbeckia subtomentosa (Sweet Coneflower)	Yellow	August to September	4 to 5 feet



DISTRICT 6, TOWN OF NAPLES, ONTARIO COUNTY

See opposite page

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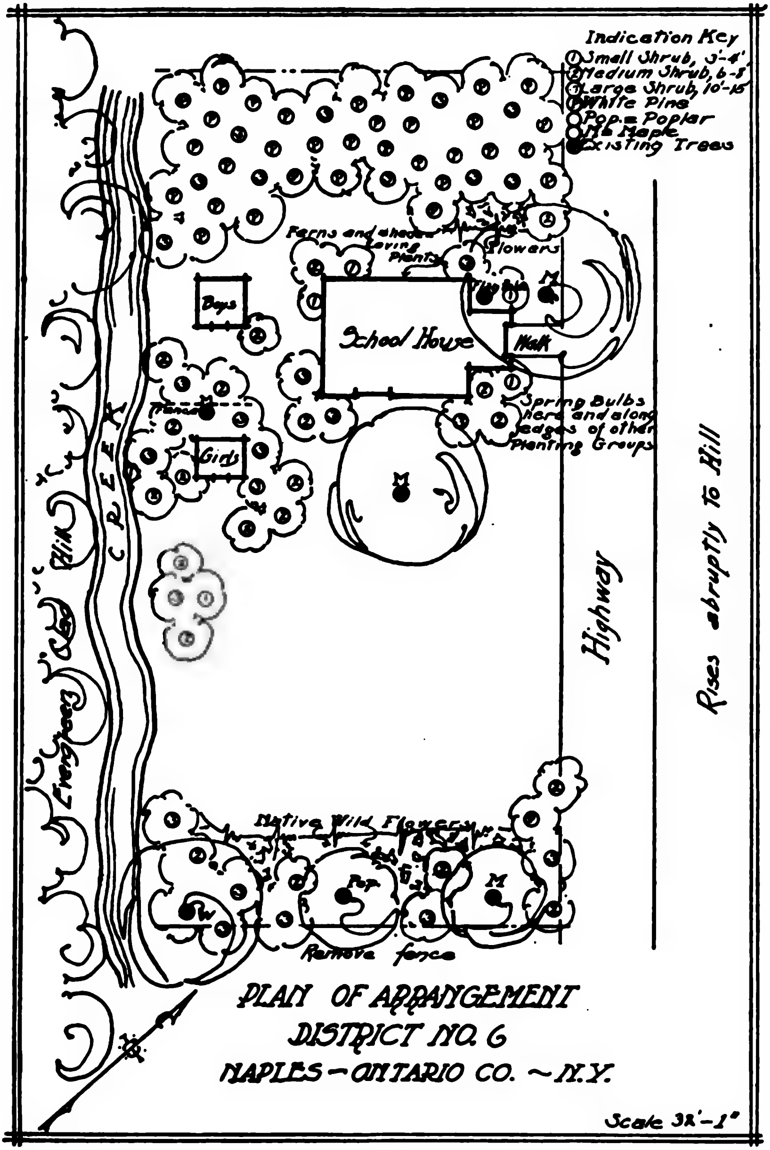
NOTES ON IMPROVEMENT PLAN

This little white schoolhouse has at least three advantages that many country schools do not have. The evergreen hill at the back gives a



wonderful setting and background. The stream at the foot of the hill affords a place to plant many native things which will add great interest to the already attractive school environment. And the little playgrou-

is almost ideally located with hill and stream at the back, schoolhouse on one side, and highway in front.

The playground is very tiny, but fortunately it has been kept open and not cluttered up by unnecessary trees. There is an existing maple near the schoolhouse and an old willow and a row of poplars along the lower end. Along the stream is a wire fence, which should be removed in order to bring the stream and the hillside into the school picture and to allow the children free access to the water's edge.

There are only a few other things needed by this school in order to put on the finishing touches and make it a beautiful little country school. First, a solid evergreen windbreak is needed on the northwest side. At this point is now an open field, as shown on the right of the photograph. The arrow in the lower corner of the plan of arrangement points north, which means that the schoolhouse faces northeast. A planting of pine trees behind and to the right of the school building will give both the wind protection and the background and framework needed in this quarter.

Second, some screen planting of shrubs is needed about the two outhouses and also some shrub groups to soften the corners of the building. These are indicated on the plan by the numbers 1, 2, and 3, which show whether the plants should be of small, medium, or large growing kinds. The stone foundations should be covered with Boston ivy, and also some other good vine, such as Japanese clematis, Hall's honeysuckle, or wistaria, should be trained over the doorway.

Finally, the finishing touch should be given by the planting of bulbs, flowers, and native plants here and there to add color and interest at different seasons of the year. These should not be set in a hole in the lawn but should always be planted against a background, such as the vine-covered foundations, the front of a shrub group, or along the edge of a tree or shrub border. A proper background is as fundamental to flowers as to the school building itself.

CORN DAY

(Friday, December 7, 1917)

Corn Day is a well-established festival in the schools of the State. Some schools celebrate it annually, others every two or three years. Space does not permit an extended discussion of Corn Day in this leaflet. The more important considerations may be summarized as follows:

1. Corn Day may well be a general harvest festival at the end of the harvest season.

2. It does not necessarily have to be held on December 7, but this date is suggested as the official Corn Day.

3. There should be an exhibit and a program.

4. Plans and study should be made for some weeks preceding the event so that the greatest good may come from it.

5. The schoolroom should be appropriately decorated.

6. The parents and members of the community should be invited.

7. A prominent feature of the exhibit should be the display of corn selected by the pupils in accordance with their knowledge of what constitutes a good ear.

8. As many of the four general types of corn should be represented as possible: flint, dent, sweet, and pop.

9. Each ear should be carefully labeled with a white paper band one inch wide fastened around the middle of the ear so that it will be right side up when the ear is held by the butt. The label should contain the following information:

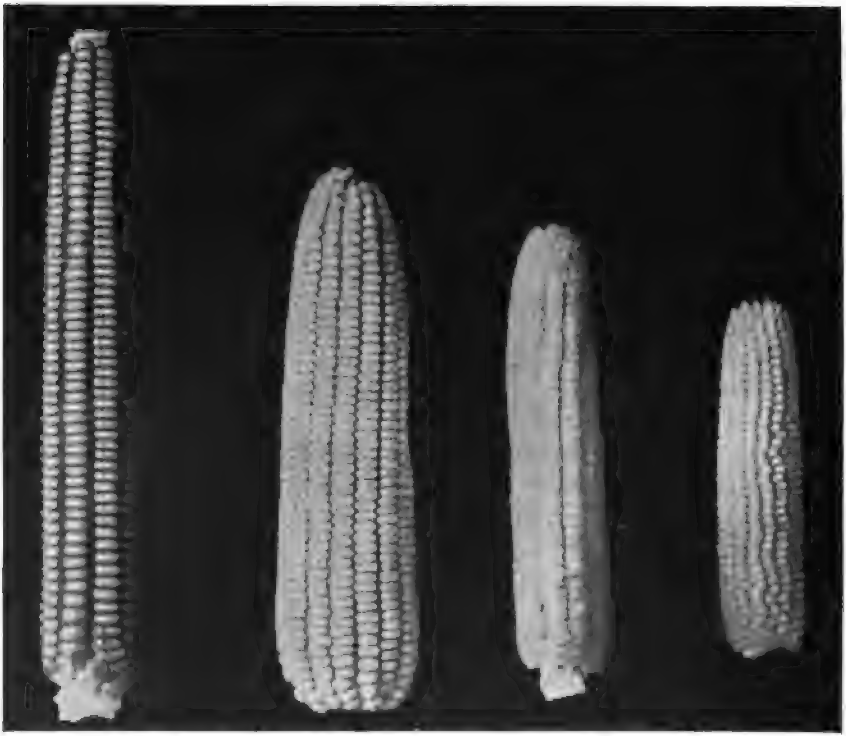
...................................County
District number......................Town of..................
..............................Teacher
Post office.., New York
.................................., District Superintendent

10. A farmer or some other person who is qualified to do the judging, should be asked to judge the corn, choosing the best ear of each type. Ribbon awards may be given to add to the interest, and second and third awards can be made in addition to first place if there is a large amount of corn.

11. If possible, the best ear of each type should be sent to the State College of Agriculture for the Farmers' Week corn show. There are many advantages to the boys and girls resulting from such a plan. It teaches lessons in wrapping, addressing, and mailing packages. It gives them contact with their State College. It brings a broader outlook.

For some reason the number of schools represented in the corn show has fallen off greatly in the last few years. In 1917 there were onl

two hundred and fifty-two; whereas in 1915 there were eight hundred and ninety-two. It is possible that the poor corn seasons may account for this. Indications, however, have come from some districts that parents have criticised the practice and objected to sending the corn away. Surely, a little explanation on the part of the teacher and a correct presentation of the matter by the children at home should serve to change this feeling. Any district should be glad to contribute an ear or two



THE STATE PRIZE EARS OF CORN, FARMERS' WEEK, 1917

Flint: District 3, Town of Newburg, Orange County
Dent: District 6, Town of Edmeston, Otsego County
Sweet: District 3, Town of Claverack, Columbia County
Pop: District 1, Town of Ballston, Saratoga County

of corn, even the best to be found, toward the education of the children. It should be made plain that the College has no motive in asking for the corn beyond that of giving an educational opportunity to the schools. True it is that all the ears cannot be returned because of the expense involved, but those that receive prizes are returned and any others will be sent back if request is made and postage furnished. The other ears are given away to Farmers' Week visitors who agree to plant the seed and to write to the schools, and some is used by the students in studying

the types and varieties from the different sections of the State. None is wasted; all serves the common good.

The conditions in regard to sending ears of corn for Farmers' Week are as follows:

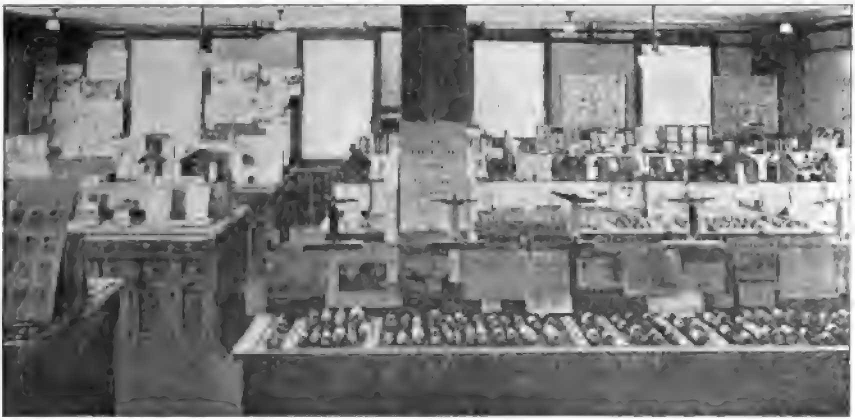
a. Only one ear of each type should be sent. This means that a school may be represented by from one to four ears.

b. Each ear should have a label giving full information.

c. The corn should be carefully wrapped and addressed to Edward M. Tuttle, College of Agriculture, Ithaca, New York.

d. The corn should be sent to reach the College not later than January 31, 1918. It would be best to send it as soon after Corn Day as possible.

e. A report of the celebration of Corn Day at the school should be mailed in a separate envelope at the same time that the corn is sent.



A GENERAL VIEW OF THE RURAL SCHOOL EXHIBITION, FARMERS' WEEK, 1917

12. It has seemed desirable to make a change in the method of awarding prizes in the Farmers' Week corn show. In 1918 the practice will be as follows:

a. Every school sending corn will receive a mark of recognition, a ribbon, or a badge, or a certificate, as seems best when the time comes.

b. Every ear sent will be eligible to compete for the state prizes. First, second, and third state prizes will be given in each of the four types: flint, dent, sweet, and pop.

c. Whenever more than ten ears of any type are sent in by the schools of a county, county prizes will be given. Heretofore county prizes have been given regardless of the number of schools represented. Obviously it did not mean the same for a school to win a county prize where it was alone or in competition with only one or two others, as it did for a school where the competition was keen. But all deserve recognition, and it is

hoped that the new plan will be acceptable and that this year again a large number of schools will take advantage of the opportunity for the development of interest and worth while activity afforded by the Farmers' Week corn show.

GENERAL EXHIBITION FOR FARMERS' WEEK, FEBRUARY, 1918

It is not possible to give in this leaflet a full discussion of the Farmers' Week exhibition of school work, and an extended presentation of the standards involved in the various classes. Teachers should refer to the September 1916 leaflet, pages 359–393. If a copy is not available one may be obtained by addressing the Editor, Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York.

In this leaflet will be found the rules governing the 1918 exhibition, the classes of exhibits, pictures of the exhibits last year and of some of the more striking specimens, and extracts from letters from teachers touching on this phase of the work.

Just a word should be said in regard to the exhibition of a year ago. It was larger than ever, but the most striking feature was the improvement in quality. This is most gratifying, and shows that schools are rapidly recognizing the standards in the different classes, and are taking pride in having the work right. It is safe to say that few things at Farmers' Week are as popular as the school exhibit, and the room is thronged from morning until night. It would do the schools that are represented good to hear the comments that are made, many of the most significant coming from farmers who are fast recognizing the value of the work. One prominent educator after inspecting the exhibit said: "The rural schools have produced here as fine a showing as I ever saw in any exhibit of city school work." In 1917 there were 261 schools represented, by 608 specimens, some sending work in as many as 9 classes. A complete report will be found as usual in the supplement to the November leaflet.

RULES FOR THE EXHIBITION

1. The best exhibits are those that are the result of considerable time and study. The value derived from preparing specimens hurriedly at the last moment is questionable.

2. Great care should be taken to follow the standard requirements in each class. Unless this is done it is impossible to render fair decisions in the judging.

3. The work exhibited should be exactly what it is described to be. A specimen may be prepared by one or two pupils or by the whole school

working together, but when sent to the College it represents the school and not an individual.

4. All work sent should have been done by the children themselves since last Farmers' Week. This provides for the inclusion of work done last spring and summer as well as that done since the opening of school this fall.

5. A single school may send specimens in any or all of the twenty-three classes, but only one specimen in each class should be sent.

PART OF THE RURAL SCHOOL EXHIBITION, FARMERS' WEEK, 1917

See also page 21

6. Each article should be carefully labeled, giving fully the following information: (a) the exhibit class number; (b) the district number of the school; (c) the name of the township; (d) the name of the county; (e) the name and address of the teacher; (f) the name, age, and grade of the pupil if it is individual work; (g) the period of time covered in the preparation of the specimens; and (h) any specific data called for by the particular class.

7. The material should be sent to Edward M. Tuttle, College of Agriculture, Ithaca, New York, and should reach the College not later than January 31, 1918.

8. Every school sending an exhibit will receive a ribbon or a certificate in recognition of the effort made. In addition first, second, and third ribbon prizes, and as many honorable mentions as the judges think are deserved, will be awarded in each of the twenty-three classes. There will also be given three grand prizes to the schools making the highest scores, counting a first prize as seven points, a second prize as five points, a third prize as three points, and an honorable mention as one point.

9. All sewing work will be returned without special request. No other specimens will be returned unless at the time of sending them a special request is made, and the required postage is furnished. It is very important that this rule should be understood in order to avoid misunderstandings later.

10. Every possible effort is made at the College to keep a record of each specimen and to care for the material until the exhibit is over. It must be clear, however, that with the great quantity of work involved there are possibilities of error and of loss. Errors in record will be corrected if attention is called to them, but the College cannot be responsible for losses. Up to the present time no serious losses have occurred, and it is hoped that they may not occur in future, but schools should understand this basis of agreement when exhibits are sent.

CLASSES OF EXHIBITS

1. One tree mount showing, if possible, leaves, flowers, fruit, young and old bark, and longitudinal and cross sections of the wood of a single species, accompanied by a statement from the teacher of the total number of different species represented by such mounts in the school collection.

2. One mount of an apple fruit spur at least ten years old, with the parts labeled and with a story of its life history.

3. One bird's nest well mounted, with a written description and an original drawing of the species of bird to which it belonged, accompanied by a statement from the teacher of the total number of different nests in the school collection.

4. Two mounts of poultry feathers arranged on full-sized outlines of the birds: one mount of the feathers of a hen, the other mount of the feathers of a cock, both of the same breed and variety.

5. Collection of ten wild flowers mounted on separate sheets representing selections from the school herbarium, accompanied by a statement from the teacher of the total number of different specimens in the herbarium.

6. Collection of three mounts: one grain, one grass, and one clover.

7. Collection of five weeds mounted on separate sheets, with description of the injury and the method of control of each species.

8. One mount showing the different feeds given to poultry in the local district.

9. One mount showing the products from cattle.

10. One mount showing the life history of some injurious insect, with a description of the method of control.

11. One birdhouse.

12. One balance for seed testing.

13. One machine-made kitchen apron.

14. One handmade combination apron.

15. One stocking with a fair-sized hole darned.

16. One napkin hemmed by hand.

17. One linen napkin ring, handmade.

18. One bird calendar showing observations of the fall or the spring migration.

19. One weather record showing observations for a month.

20. One drawing of natural scenery, to be made from the scene itself, not copied.

21. One drawing of some natural history object, to be made from the object itself, not copied.

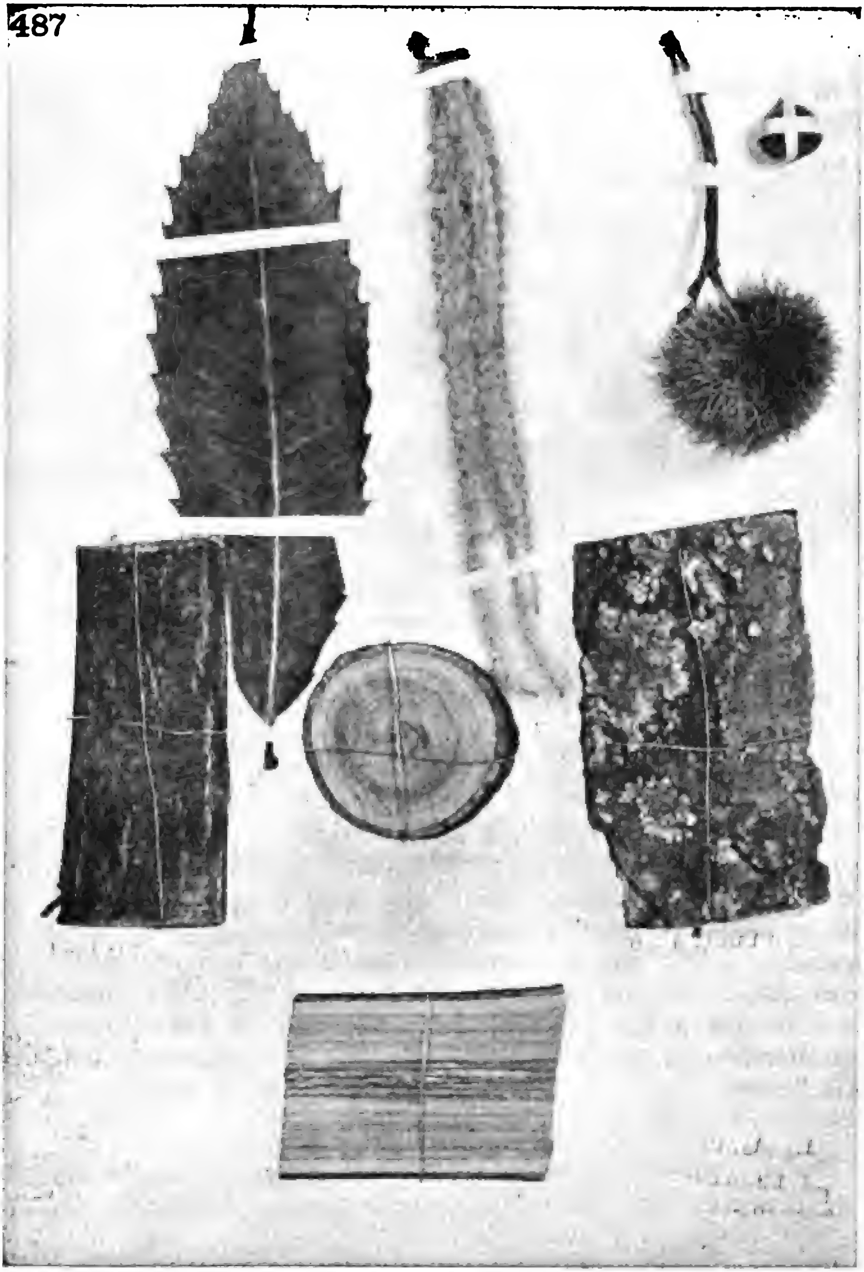
22. One drawing of a domestic animal, to be made from the animal itself, not copied.

23. One original notebook on some one phase of natural history, agriculture, or home making.

The miscellaneous class has been dropped. It detracted from the interest in the regular classes, which are more definite and more valuable in educational growth, and there was a good deal of material sent in the miscellaneous class last year which could not wisely be advocated for school work. On the other hand, one or two excellent suggestions grew out of this class a year ago. If any school has a particular piece of work that it feels would be instructive and interesting, permission to enter it on a non-competitive basis may be obtained by writing to Mr. Tuttle.

For complete explanations of the different classes and the standards to be followed in each class refer to pages 362–393 of the September 1916 number of the Cornell Rural School Leaflet.

On the following pages there are illustrations of a few of the most interesting and striking specimens sent by schools to the Farmers' Week exhibition last year.

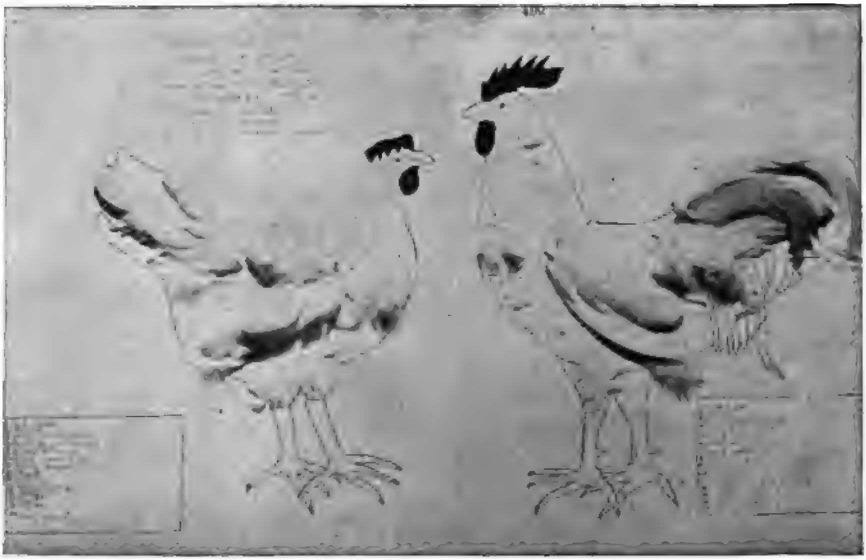


PRIZE TREE MOUNT, FARMERS' WEEK, 1917

About one-half natural size. From District 10, Town of Newfield, Tompkins County

PRIZE APPLE FRUIT-SPUR MOUNT, FARMERS' WEEK, 1917

About one-half natural size. From District 11, Town of Neversink, Sullivan County

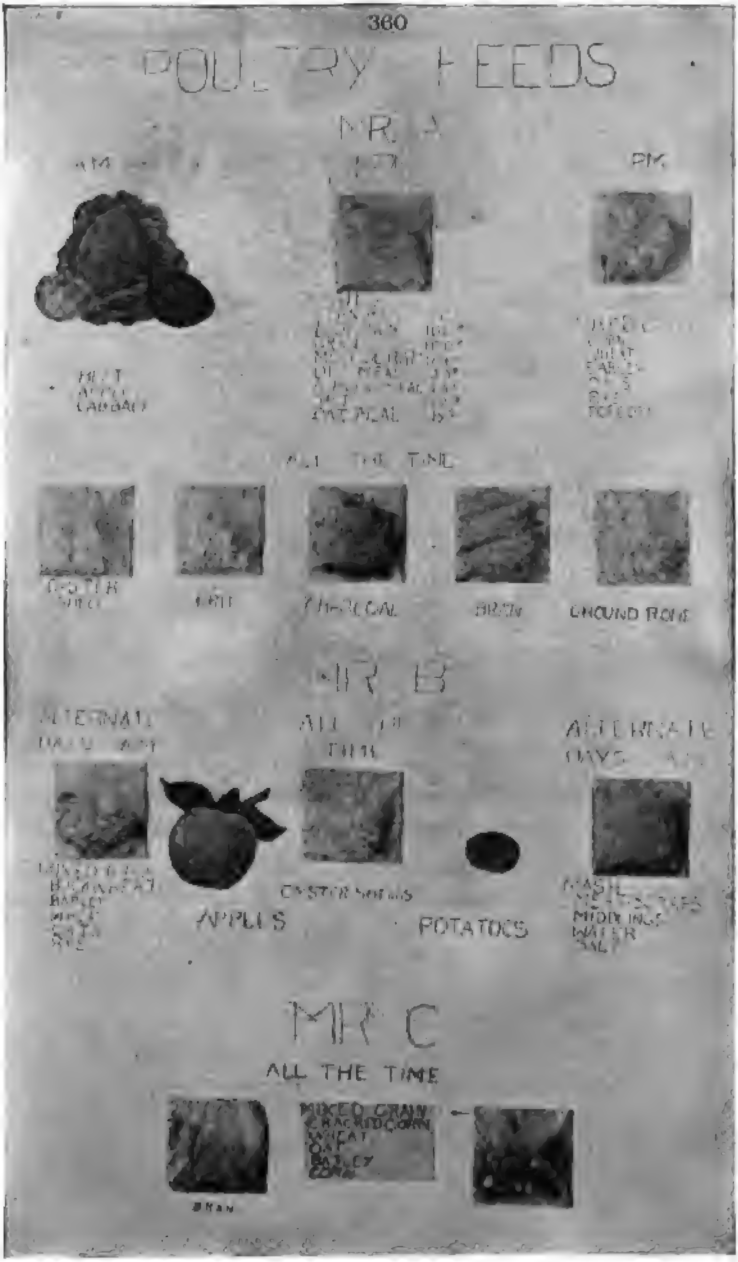


PRIZE POULTRY FEATHER MOUNT, FARMERS' WEEK, 1917
About one-sixth natural size. From District 8, Town of Danby, Tompkins County

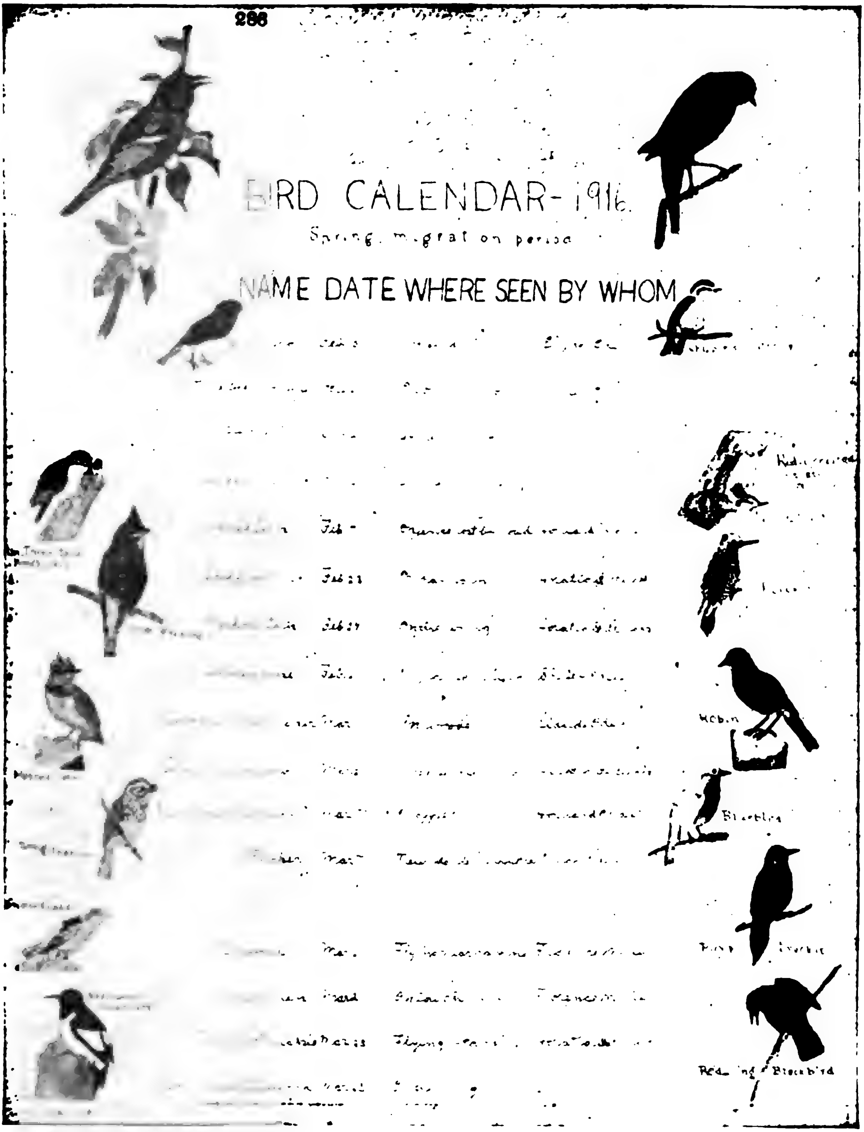
PRIZE BIRD'S NEST MOUNT, FARMERS' WEEK, 1917
About one-sixth natural size. From District 4, Town of Bath, Steuben County

PRIZE GRAIN, GRASS, AND CLOVER MOUNTS, FARMERS' WEEK, 1917
About one-sixth natural size. From District 10, Town of Newfield, Tompkins County

PRIZE CATTLE PRODUCT MOUNT, FARMERS' WEEK, 1917
About one-sixth natural size. From District 10, Town of Newfield, Tompkins County



PRIZE POULTRY FEED MOUNT, FARMERS' WEEK, 1917
About one-third natural size. From District 11, Town of Catharine, Schuyler County



PRIZE BIRD CALENDAR, FARMERS' WEEK, 1917

About one-sixth natural size. From District 4, Town of Bath, Steuben County. There were five sheets like this one. The birds were all done in water colors by three of the pupils

JUNIOR HOME PROJECT WORK

F. L. Griffin
Professor of Rural Education

Editor's note.— Last year a complete discussion of *The Nature and Procedure of Junior Home Project Work* was given by Professor Griffin in the leaflet. Naturally the experience of twelve months brings new points of view, clarifies ideas, and suggests changes and improvements. In the following article the situation in regard to junior home project work as it stands at the present time is briefly outlined. It should always be borne clearly in mind that this work is a part of the general nature study movement in schools, that for its greatest success it must be based on interested study and investigation that children have carried on all during their school life, and that its value lies in the opportunity it affords to set certain definite and intensive activities into the broad background development resulting from intelligent and sympathetic contact with the environment.

In times like the present when the tendency is to loosen school ties and to encourage children to engage in work often beyond their capacity for sustained effort, the home project plan of instruction and production should be carefully considered, since it offers what is believed to be a fundamentally sound method for encouraging a child to "do his bit," and at the same time it strengthens rather than weakens his relationship with the school.

Two kinds of home project work have been suggested, based on whether or not it is undertaken for academic credit. In order that the proper distinction may be made between the two phases of the work and to prevent a misunderstanding as regards terminology it is suggested that the home projects for which Regents' counts may be given be known as the *credit projects*, while those that are undertaken on a contest basis be known as *contest projects*. It is further suggested that boys and girls undertaking the credit projects be known as *project students*, while those enrolled for contest work be called *contestants*.

The following method is suggested for starting either credit or contest work along home project lines in any school or supervisory district:

1. The superintendent of schools shall decide and notify the teachers regarding the kind of work to be undertaken in the schools under his supervision and suggest the home projects to be considered.

2. The teacher should then take up the work with her pupils, encourage them to undertake one of the designated projects, and notify the State Leader of Junior Extension Work, College of Agriculture, Ithaca, New York, of the probable number of project students so that the required number of copies of the circular outlining the work may be sent.

3. Each pupil who is interested in the work should be given a copy of this circular to take home. He should discuss the work thoroughly with his parent. If the parent's consent is obtained, the pupil should fill out in duplicate the enrollment blanks printed on the last page of the circular. The enrollment blanks, after being signed by the parent, are to be returned to the teacher.

4. The teacher shall send one of the enrollment blanks to the Department of Rural Education, New York State College of Agriculture, Ithaca,

PART OF THE SCHOOL EXHIBIT, ONTARIO COUNTY FAIR, 1916

New York, and give the other to the district superintendent of schools, first making a record of those taking up the work for her own use.

5. On receipt of the enrollment blanks the College of Agriculture will send preliminary instructions for starting the work both to the pupils and to the teacher, and these will be followed by others from time to time.

6. The project students and contestants will be supplied with record books in which to keep a labor and financial account of their work. It is important that the records be both accurate and complete as they will form the basis of the district superintendent's recommendation that academic credit be given for the credit project work. They will also

count as a possible twenty points in the basis of awards in all the contest work.

In all of the junior home project work it is suggested that the boys and girls be divided into three classes according to their ages so that there will be a more equitable basis for competition. Members of an older grade should not be permitted to compete with those belonging to the younger grade although nothing should prevent the younger boys and girls from competing in a more advanced grade. The junior home project work is limited to children under eighteen, and the class divisions suggested are as follows:

Class A. Ages up to 11 inclusive
Class B. Ages 12 to 14 inclusive
Class C. Ages 15 to 18 inclusive

In the case of credit projects, children must be above the sixth grade or twelve years of age or older.

THE DISTRIBUTION OF THE CORNELL RURAL SCHOOL LEAFLET

The first number of the leaflet for each school year is published in September and is known as the subject-matter leaflet. It reaches all teachers of elementary grades without individual request on their part. The names of all teachers under rural supervision are obtained at the earliest possible date from the district superintendents, and a copy of the September leaflet is sent directly to each teacher. Grade teachers in cities and villages having a superintendent of schools receive the leaflet from their superintendent, to whom copies are sent in bulk for distribution.

Every teacher in New York State below the high school is entitled to a copy of the September leaflet. In the case of teachers under city or village supervision, this is the only leaflet available to them during the year. In the case of teachers under rural supervision, the numbers of the Cornell Rural School Leaflet designed for children are available. They may be obtained as follows:

Accompanying the September teachers' leaflet will be found a blank form for the names of pupils. This blank should be filled out immediately and returned to Edward M. Tuttle, College of Agriculture, Ithaca, New York. The pupils' names will then be placed on file, and each teacher will be sent a sufficient number of copies of the leaflets for boys and girls to supply the school. The editor hopes to send three leaflets for children — one in November, one in January, and one in March. These are distributed to the pupils by the teacher.

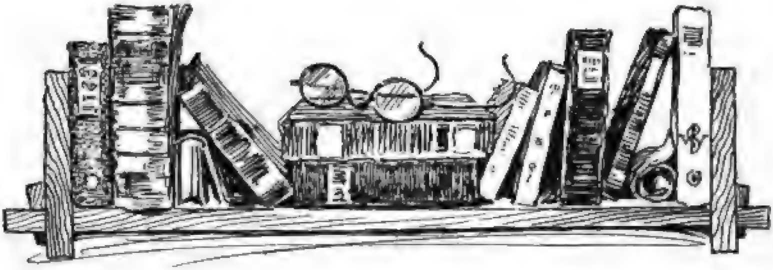
To summarize: In order to perfect the method of distribution, teachers in elementary schools under rural supervision should remember the following:

1. A copy of the September number of the Cornell Rural School Leaflet for teachers will be received through the mail early in the school year.
2. A blank accompanies the teachers' leaflet, which is to be used only by teachers of elementary grades under the supervision of district superintendents of rural schools. (See the page inside the back cover.)
3. The blank should be carefully filled out with name and address, district number, township, county, name of district superintendent, and names of pupils.
4. The blank should be returned at once to Edward M. Tuttle, College of Agriculture, Ithaca, New York.
5. Three times during the year a package of children's leaflets will be received through the mails.
6. These leaflets should be distributed to the pupils whose names were on the list sent.
7. Any changes of teacher or pupils in the school should be reported in detail at once, in order that the records at the College of Agriculture may be complete and accurate, thus enabling prompt, correct, and effective distribution of the Cornell Rural School Leaflet.

DISTRIBUTION IN 1916–1917

Persons receiving the leaflets	
Rural teachers	14,331
City and village teachers	28,781
Training class pupils	1,320
Training- and normal-school pupils	1,792
Pupils in rural schools	184,710
Total	230,934
Number of copies distributed	
Total rural teachers (one number)	14,331
10,127 teachers who returned lists of pupils (three additional numbers)	30,381
City and village teachers (one number)	28,781
Training class pupils (four numbers)	5,280
Training- and normal-school pupils (four numbers)	7,168
Pupils 184,710 (three numbers)	554,130
Total	640,071

REFERENCE BOOKS



The following are the titles, the authors, and the publishers of a number of books that have proved their value for reference use. They range in price from less than $1 to as much as $4. Prices can be obtained on application to the publishers or to the editor of the leaflet.

1. NATURE STUDY AND ELEMENTARY AGRICULTURE

Nature-study leaflets (bound volume). College of Agriculture, Ithaca, New York. Available to teachers for 15 cents to cover postage

The nature-study idea. Bailey. The Macmillan Company, New York

Nature-study and life. Hodge. Ginn & Co., Boston

Handbook of nature-study. Comstock. Comstock Publishing Company, Ithaca, New York

Elements of agriculture. Warren. The Macmillan Company, New York

Agriculture for beginners. Burkett, Stevens, and Hill. Ginn & Co., Boston

Beginnings in agriculture. Mann. The Macmillan Company, New York

New elementary agriculture. Bessey and others. University Publishing Company, Lincoln, Nebraska

Essentials of agriculture. Waters. Ginn & Co., Boston

The great world's farm. Gaye. The Macmillan Company, New York

Sharp eyes. Gibson. Harper & Bros., New York

Eye spy. Gibson. Harper & Bros., New York

2. HOME MAKING

Textiles. Woolman and McGowan. The Macmillan Company, New York

A sewing course. Mary Schenck Woolman. Frederick A. Fernald, Washington, D. C.

Food products. Henry C. Sherman. The Macmillan Company, New York

Foods and household management. Kinne and Cooley. The Macmillan Company, New York

3. WOODWORK

Problems in farm woodwork. Blackburn. The Manual Arts Press, Peoria, Illinois

4. PLANT LIFE

Plants and their uses. Sargent. Henry Holt & Company, New York
Principles of botany. Bergen and Davis. Ginn & Co., Boston
Manual of botany. Gray. American Book Company, New York
Our native trees. Keeler. Charles Scribner's Sons, New York
Our northern shrubs. Keeler. Charles Scribner's Sons, New York
Trees of northern United States. Apgar. American Book Company, New York
A first book of forestry. Roth. Ginn & Co., Boston
Manual of gardening. Bailey. The Macmillan Company, New York
Garden-making. Bailey. The Macmillan Company, New York
Cereals in America. Hunt. Orange Judd Company, New York
Corn plants. Sargent. Houghton Mifflin Co., New York
Field crops. Wilson and Warburton. The Webb Publishing Co., St. Paul, Minnesota
Textbook of grasses. Hitchcock. The Macmillan Company, New York
Field book of American wild flowers. Mathews. G. P. Putnam's Sons, New York
A manual of weeds. Georgia. The Macmillan Company, New York
Our ferns in their haunts. Clute. Frederick A. Stokes & Co., New York
Mosses with a hand lens. Grout. O. T. Louis Company, New York
Mushrooms. Atkinson. Henry Holt & Co., New York

5. ANIMAL LIFE

Handbook of birds of eastern North America. Chapman. D. Appleton & Co., New York
Bird guide. Reed. Doubleday, Page & Co., New York
Bird homes. Dugmore. Doubleday, Page & Co., New York
Manual of the vertebrates. Jordan. A. C. McClurg & Co., New York
American animals. Stone and Cram. Doubleday, Page & Co., New York
American food and game fishes. Jordan and Everman. Doubleday, Page & Co., New York
The reptile book. Ditmar. Doubleday, Page & Co., New York
Beginnings in animal husbandry. Plumb. The Webb Publishing Co., St. Paul, Minnesota

Feeds and feeding, abridged. Henry and Morrison. The Henry-Morrison Co., Madison, Wisconsin

Productive poultry husbandry. Lewis. J. B. Lippincott Co., Philadelphia, Pennsylvania

Milk and its products. Wing. The Macmillan Company, New York

The horse. Roberts. The Macmillan Company, New York

Insect life. Comstock. D. Appleton & Co., New York

Moths and butterflies. Dickerson. Ginn & Co., Boston

The spider book. Comstock. Doubleday, Page & Co., New York

6. EARTH SCIENCE AND ASTRONOMY

New physical geography. Tarr. The Macmillan Company, New York

Soils. King. The Macmillan Company, New York

The children's book of stars. Mitton. The Macmillan Company, New York

7. NATURE POETRY

A child's garden of verses. Stevenson. Charles Scribner's Sons, New York

Songs of nature. Edited by John Burroughs. McClure, Phillips & Co., New York

PRIZE BIRDHOUSE, FARMERS' WEEK, 1917
One-fourth natural size. From District 4, Town of Bath, Steuben County

INDEX

IMPORTANT NOTICE

READ CAREFULLY ARTICLE ON PAGE 316

This blank is to be used in applying for the leaflets for boys and girls.

All teachers of elementary grades under rural supervision may receive the children's leaflets on request. This includes grade teachers in villages of less than 5000 population.

There are not sufficient funds to send children's leaflets to cities and villages of over 5000 population.

Please fill out this sheet carefully and mail it promptly to

Edward M. Tuttle
Editor Cornell Rural School Leaflet
College of Agriculture
Ithaca, New York

Teacher's name..

Post-office address (school)..

....

Post-office address (home)..

....

Number of school district..

Name of township..

Name of county..

Name of district superintendent..

Number of teachers in the school..

Number of pupils in your charge..

PUPILS

NAME	AGE	GRADE
1		
2		
3		
4		
5		
6		

	NAME	AGE	GRADE
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8			
9			
10			
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CORNELL RURAL SCHOOL LEAFLET

PUBLISHED BY THE DEPARTMENT OF RURAL EDUCATION, NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

VOLUME XI | ITHACA, NEW YORK, NOVEMBER, 1917 | NUMBER 2

SUGGESTIONS FOR ORGANIZING AND SUPERVISING JUNIOR HOME PROJECT WORK

F. L. GRIFFIN

THIS ISSUE IS FOR SUPERVISORS AND TEACHERS

Entered at the post office at Ithaca, New York, as second-class mail matter

Cornell Rural School Leaflet

PUBLISHED BY THE DEPARTMENT OF RURAL EDUCATION OF THE NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY, ITHACA, NEW YORK

ALBERT R. MANN, DEAN OF THE COLLEGE
GEORGE A. WORKS, HEAD OF THE DEPARTMENT

SUPERVISOR AND EDITOR
OF THE LEAFLET

EDWARD M. TUTTLE

EDITOR FOR JUNIOR
HOME PROJECT WORK

F. L. GRIFFIN

ADVISORS

LAYTON S. HAWKINS
(Director Division of Agricultural and Industrial Education, University of the State of New York)

GEORGE N. LAUMAN
(Head of the Department of Rural Economy, New York State College of Agriculture)

MERTON R. PORTER
(President New York State Association of District Superintendents, 1917)

GEORGE F. WARREN
(Head of the Department of Farm Management, New York State College of Agriculture)

CORNELL RURAL SCHOOL LEAFLET

VOLUME XI — ITHACA, NEW YORK, NOVEMBER, 1917 — NUMBER 2

SUGGESTIONS FOR ORGANIZING AND SUPERVISING JUNIOR HOME PROJECT WORK

F. L. GRIFFIN

THE junior home project plan of instruction in elementary agriculture and home making in the State of New York is based on the report of the committee appointed by the president of the Association of District Superintendents to obtain information concerning boys' and girls' club work and the teaching of agriculture in the elementary schools. By means of a questionnaire this committee obtained data and suggestions from all the superintendents having experience in this work. The report was presented at the Utica meeting of the district superintendents in 1915, and the recommendations of the committee, which were unanimously adopted and later approved by the Commissioner of Education, are as follows:

1. That the term *project* be applied to directed study plus supervised home work in the fields of elementary agriculture and home making. (To distinguish between the elementary home project work and the high school vocational work in agriculture and home making, the former shall be referred to as the junior home project work and the latter as the senior home project work.)
2. That such projects may be undertaken by any boy or girl who will agree to faithfully carry out the instructions governing the carrying on of the project.
3. That such projects may be undertaken for school credit by pupils of the seventh and eighth grades or by those twelve years of age or over.
4. That the State Department of Education be asked to give Regents' credit for such projects, on the basis of one count for forty-five minutes a week of classroom instruction plus a properly supervised project, a maximum of two counts for any one pupil to be credited after high school entrance, credit to be given on certification of the district superintendent.
5. That the responsibility for the local organization and direction of credit projects be taken by the district superintendents, who should exercise care in directing the assistance that may be given by outside agencies.
6. That in a given year a district superintendent undertake few credit projects, and that emphasis be laid on obtaining definite results from every child who begins a project rather than on a large number of entries.
7. That the State Department of Education be asked to include in the syllabus on elementary agriculture suggestions for credit projects for the seventh and eighth grades.
8. That the State Department of Education be asked to furnish the record blanks and directions necessary to put effectively in operation the project plan of instruction.

9. That the State College of Agriculture be asked to furnish subject matter for teachers and pupils in a form suitable for the project plan of instruction.
10. That a decided stand be taken to discourage the offering of prizes the value of which is disproportionate to the effort required on the part of the pupils taking part in exhibitions or contests.
11. That a permanent committee be appointed to act as the representative of this body in relation to the foregoing recommendations.

An amplification of the recommendations of the committee as set forth above, with such desirable modifications and additions as experience has indicated, has resulted in the suggestions for the organization and supervision of the junior home projects that follow. With the hope that these suggestions will be useful to the project workers, as well as of service to parents, superintendents, teachers, farm bureau managers, and other adults interested in the development of boys and girls thru agricultural and home-making activities, this leaflet has been prepared.

THE POINT OF VIEW

The situation growing out of the great war has resulted in unusual stress being placed on the production of foodstuffs, as well as on the proper preparation and preservation of food and clothing, and the youth of the land have been called on to render service along these lines more extensively and efficiently than ever before. Many different agencies have become interested in promoting productive activities among boys and girls. While the motives on which such work has been based have most often been of the best, there has been some unwise duplication of effort in the organization of the work, and there is always the danger that children may be used in a manner not conducive to their proper development when their activities are directed by individuals or organizations not primarily interested in education.

It is believed that the home project method of instruction in elementary agriculture and home making as set forth in this leaflet will prevent any selfish exploitation of the boys and girls, will elimimate all unnecessary duplication of effort on the part of those interested in juvenile agricultural activities, and will place all work of an agricultural nature among children in New York State on a strictly educational basis. In the operation of this plan the College and the State Department of Education are cooperating.

THE PRINCIPLES GOVERNING JUNIOR PROJECT WORK

The following conclusions, based on the experience of those members of the College of Agriculture who have had to do with junior extension work in the past, embody the principles that will govern such work in the future:

1. All the extension activities of the New York State College of Agriculture at Cornell University among boys and girls of the State are to be ·imarily educational in nature.

2. The public school system offers the best agency for carrying the message of the College concerning better farming and better living to the children of the State.

3. The superintendents of schools, by virtue of their office, are the logical leaders in all educational movements among the boys and girls attending the schools under their supervision. The city, the village, the supervisory district, or the township affords a convenient and efficient working unit for the organization and supervision of junior extension work. The

TEAM WORK. A POTATO PROJECT WORKER AND HIS FRIENDS

Only the county agent is needed to make the group complete. Those present are the mother, the father, the grandmother, the district superintendent of schools, the banker, the state leader of junior project work, the local leader who supervised the work, the boy, his brother, and his sister

cooperation of parents, the farm bureau, and local organizations, is vital to the development of the home project work, and it is the function of the superintendents of schools to enlist such assistance.

4. The success of home project work is dependent on the amount of systematic and permanent direction and follow-up work given. Such activities should not be undertaken unless proper provision is made for having adult leaders available for supervising the home projects during both the school year and the vacation period.

Since the home projects are placed on a productive basis, it is possible to make the value of the resulting products reach a sum that, in the aggregate, is much greater than the cost of any supervision that may be necessary. The educational benefits derived by the boys and girls from their work, however, which cannot be estimated in terms of money, will alone justify the expense of such supervision.

The boards of education in cities, villages, towns, and union free school districts can well afford to employ a special instructor of agriculture and of home making or a director of agriculture, under the terms of the Vocational Education Law, which permits the State, thru the State Department

A STEUBEN COUNTY SCHOOL EXHIBIT

A school fair exhibit should mark the termination of all school-home project work

of Education, to pay two-thirds of the salary of the vocational teacher of agriculture, one-third of the salary of the vocational teacher of home making, or one-half of the salary of the director of agriculture.

5. School fairs and contests are worthy of being encouraged in every community in the State every year. No other enterprise does so much to awaken interest, set higher standards, and create a feeling favorable to the promotion of better practice in agriculture and home making. The efforts of the children take root in the home life, and the people of the community can observe the growth and measure the results in terms of economic value as well as in the development of the boys and girls.

The value of the school fair or festival, which should mark the termination of all home project work, is in direct ratio to its nearness to the chil-

dren concerned. This is why local and town school fairs should be encouraged every year whether district or county fairs are held or not.

6. All organizations as well as all individuals interested in the home project activities of the boys and girls, should cooperate with the school superintendents and teachers for making this work a success.

The more closely and personally it is possible to follow every boy and girl in each step of his or her work by giving advice and encouragement, the better will be the final result, both economically and educationally. Local cooperation is vital. One person cannot do it all, nor should it be

A RURAL-SCHOOL-DAY MEETING

A Westfield High School student instructing a junior home project group. Photograph by H. B. Allen agricultural instructor

expected of him. Every person and every organization should contribute something — time, materials, or money. Each will then have an interest in the outcome, and the duty of the leader will be that of guiding the efforts of all in order that greater efficiency may be obtained.

7. The aim in all home project work should be to have each child finish the piece of work that he begins. The incentive should be the child's interest in the project rather than in the prize that may be offered.

8. Every child participating in a contest of any kind who faithfully measures up to all the obligations imposed, should be given suitable recognition when the work is completed. Honorary awards, such as ribbons, emblems, achievement pins, and the like, are most appropriate.

9. When cash awards are given, the amount each individual receives should be relatively small. The aim in such cases should be to give as many cash prizes of equal amounts as possible, in each class.

"PROMISSORY NOTE" PIGS

Joseph Barron, of East Waverly, and his pigs. The First National Bank of Waverly, financed this project and many others

10. Occasions may arise when it will be appropriate to give special recognition to the individuals making the best records in a town, a district, or a county contest. Short educational trips or free attendance in a short course in some agricultural school or college may be justified as a grand prize under such conditions.

11. Experience indicates that there are many boys and girls who are interested in the junior home project work when it can be undertaken on a contest basis, but who do not care to meet the requirements for academic credit. The work, therefore, has been placed on both a school credit and a non-credit, or contest, basis. Boys and girls enrolling for either phase of the work will be known hereafter as *project workers*.

THE PURPOSE OF JUNIOR HOME PROJECT WORK

The primary purpose of junior home project work is the development of boys and girls thru agricultural and home-making interests and activities. Such thoughts and actions ought to have their source in fundamental, sound instruction in nature study, which should be part of the educational experience of all boys and girls, as has been suggested in the Cornell Rural School Leaflets these many years.

It is the aim to organize the home projects and related school work on such a basis as to enable the project workers to derive the maximum amount of pleasure and profit from their work and to experience the growth that results from directed play, supervised study, and productive effort.

A JUNIOR DAIRYMAN AND HIS PUREBRED CALF

Donald Smith, of Horseheads, whose project was financed by the Second National Bank of Elmira and supervised by T. W. Vann, county agent

Besides the quickened and deepened interest in the affairs of country life and living growing out of the development of a productive home project, the habits of industry resulting from the sustained effort necessary to complete a project, and the ideas of thrift derived from the actual earning of money and keeping of records, the school-home project work can be made to result in an actual increase of the amount of foodstuff as well as in the number of purebred livestock or the amount of selected seed produced in a community.

RUBY RIDER, OF TIOGA COUNTY, WHO FOUND PLEASURE AND PROFIT IN HER POULTRY PROJECT

In times like the present, when the tendency is to shorten the school year, to loosen school ties, and to encourage children to engage in work often beyond their capacity for sustained effort, the home project plan of instruction and production should be carefully considered, since it offers what is believed to be a fundamentally sound method for encouraging a child to "do his bit" and, at the same time, to strengthen rather than to weaken his relationships with the school.

GENERAL SUPERVISION AND FINANCIAL SUPPORT

A JUNIOR FLOCKMASTER
Leo Fisher of Steuben County

THE STATE DEPARTMENT OF EDUCATION

All educational work with children of public school age falls within the jurisdiction of the Commissioner of Education, since he and his organization are responsible for the administration of the schools of the State. Junior extension work in agriculture and home making is no exception to this rule, and the city, village, and district superintendents, who are directly responsible for the supervision of the public schools, have been authorized to promote and are made responsible for the supervision of such work in their respective districts.

THE STATE COLLEGE OF AGRICULTURE

The New York State College of Agriculture at Cornell University, thru the Department of Rural Education, and in cooperation with the Division of Agricultural and Industrial Education, New York State Department of Education, and the superintendents of schools, is assisting in the organization and follow-up phases of all the home project work.

A WAVERLY GARDENER
Julian Porras, Filipino project worker, in his garden

The Department of Rural Education receives the enrollments of boys and girls for the home project work thru the superintendents of schools and teachers, and sends to every individual enrolled the directions for carrying on the work, as well as the blanks for the cash and labor records of the project. The teachers are likewise supplied with suggestions dealing with the instructional and follow-up features of the work.

THE STATE SCHOOLS OF AGRICULTURE

The State Schools of Agriculture, located at Alfred, Canton, Cobleskill, Delhi, Morrisville, and Farmingdale, are cooperating in the promotion of the junior extension work. One or more members of the faculty of each State School of Agriculture have been designated as the district leader or leaders of all junior extension work undertaken in the territory served by the school. The district leaders will assist the State Leader in the development of the general plans for the junior work that have been approved by the State Department of Education and the New York State College of Agriculture, and, in cooperation with the superintendents of schools and their advisory committees, will help in the organization and the follow-up and exhibit phases of the work.

THE UNITED STATES DEPARTMENT OF AGRICULTURE

The United States Department of Agriculture, thru the States Relations Service, Office of Extension Work, North, is cooperating with the New York State College of Agriculture for the development of junior extension

work in the State of New York, and recognizes the home projects as coming within the letter and spirit of the Smith-Lever Act, which provides Federal aid for cooperative extension work in agriculture and home economics among boys and girls. The Federal Department assists in the development of the work by rendering financial support and by granting the use of the Government frank to the State Leader in charge of junior extension work for the College.

LOCAL SUPERVISION

THE SUPERINTENDENTS OF SCHOOLS

The superintendents of schools, by virtue of their office, are the logical leaders of all home projects and junior extension work in the schools under their supervision. On account of their manifold duties, however, it is often necessary to delegate more or less of the actual supervision of the junior projects to some one else.

The immediate supervision and direction of all junior project activities may be properly vested in the principal, the vocational instructor of agriculture or home making, or the director of agriculture.

THE ADVISORY COMMITTEE

The general direction and supervision of all junior home project work on a contest basis in a supervisory district or county should be vested in an advisory committee consisting of the district superintendent and a representative of each organization in the district or county interested in such activities among the boys and girls. The committee should be composed of three or more members, selected from the following individuals or organizations:

District, city, or village superintendent of schools

County farm bureau association

State school of agriculture

Parent-teacher association

Pomona grange

County fair association

Breeders' association

A GARDEN PROJECT GROUP AT LEROY

The projects of these boys were supervised by I. T. Francis, agricultural instructor

Banks or other business organizations

Leaders of Boy Scouts or Camp Fire Girls

Young Men's Christian Association and Young Women's Christian Association secretaries

Churches

THE COUNTY FARM BUREAU

The county farm bureau managers and the county home demonstration agents may adopt projects covering the junior extension work. A copy of this project will be filed with the State Leader of Junior Extension Work by the Farm Bureau Office at the College. Such projects may properly include the following lines of work:

1. Explaining the plan of junior extension work to such communities as may be interested.

2. Calling the attention of the superintendents of schools and the State Leader of Junior Extension Work to those communities that desire to take up the junior project work.

3. Helping the district superintendents in organizing the advisory committee that will have charge of the promotion, organization, and follow-up phases of the junior home project work undertaken in their respective districts.

A JUNIOR GARDENER AT LEROY

Rosie Panepento knows that there is money as well as pleasure in gardening

THE LOCAL LEADERS

Undoubtedly the persons best qualified to supervise the junior home project work of the boys and girls in a community, because of the nature of their work, are:

The vocational instructor of agriculture.

The vocational instructor of home making

The director of agriculture

The principal of the high school

The rural school teacher

When a person directly connected with the school is not available as local leader of the junior project work during the vacation period, the superintendent of schools may get some capable adult to volunteer his or her services as leader and to supervise the home project activities of the boys and girls in the community during that period.

ANOTHER JUNIOR GARDENER

Frank Hotchkiss, of Mexico, knows some of the possibilities of a small piece of ground

THE DIVISION OF LABOR

THE SUPERINTENDENT OF SCHOOLS

The superintendent of schools should:

1. Designate the nature and kind of home project work to be undertaken in the schools under his supervision.

2. Encourage the teachers to start the work in their schools.

3. Instruct them as regards the proper method of organizing and following up the work.

4. Serve as chairman of the advisory committee in charge of all junior home project work undertaken by the boys and girls in his supervisory district.

5. Visit the project workers in their homes whenever possible.

THE COUNTY FARM BUREAU

The county agricultural agent or the home demonstration agent may assist the school superintendents and advisory committees in the organization and follow-up phases of the junior extension work as follows:

1. By means of illustrated lectures and demonstrations arouse interest among teachers and other adults as well as give practical, technical instruction in the organization and follow-up phases of the junior home project movement.

2. Provide specific cultural directions and other information of local application for the seasonal development of the junior home projects undertaken in the county and send this information to the boys and girls in the form of mimeographed circulars or printed articles in the monthly farm bureau publication.

3. Help organize and supervise, especially during the vacation period, such follow-up activities as farm hikes, judging contests, picnics, play festivals, and the like, that will help to sustain the interest of the boys and girls in their work.

When projects covering junior extension work are adopted by the farm bureau manager, it is recommended that a member of the farm bureau association executive committee be designated as a special committee of one on junior projects to advise with and work with the county agricultural agent and home demonstration agent.

NO BUGS NOR BLIGHT

Ray Sancomb, Chateaugay, had one acre in his project. Photograph by E. W. Thurston, agricultural instructor

THE ADVISORY COMMITTEE

The advisory committee should:

1. Assist in determining the kind and the nature of the home projects to be undertaken in a district.

2. Assist in obtaining the necessary financial support to maintain the local dealers, especially during the vacation period.

3. Determine the time, the place, and the management of the school, town, or district fair, which should mark the termination of all junior home project work, and provide suitable awards.

4. Arrange for play festivals, picnics, hikes, short courses, and other summer or vacation activities designated for the special benefit of boys and girls engaged in home project work.

5. Provide or arrange a loan fund for the purpose of helping those project workers needing financial assistance. Such loans are always to be made on a business basis and the interests of the boys and girls safeguarded in every way.

THE LOCAL LEADER

The duties of the local leader include the following:

1. To explain the nature of the junior home project work to the boys and girls, and to encourage them to engage in it.

A "NORTH COUNTRY" POTATO PROJECT

Leland Walker, of North Bangor, who received a fair labor income as well as academic credit for his work

2. To enroll the boys and girls who are interested in the home projects and to help them in getting the work properly started.

3. To direct and supervise the study phases of the credit projects and related school activities.

4. To visit the project workers in their homes as often as possible for the purpose of giving encouragement and suggesting approved methods.

5. To assist the project workers in keeping their records and to collect and transmit the completed records to the superintendent of schools at the close of the work.

6. To encourage and direct the play and other social activities among the project workers, especially during the vacation period.

BRINGING IN THE SHEAVES
Hascall Du Bois, of Alfred, harvesting his crop. Photograph by C. O. Du Bois

7. To act as the group leader on all excursions, picnics, hikes, and the like.

THE STATE COLLEGE OF AGRICULTURE

The New York State College of Agriculture at Cornell University, thru the Department of Rural Education, will furnish:

CROP INSURANCE
Frank Gentile, of Westfield, at work in his potato project. Photograph by H. B. Allen, agricultural instructor

1. The necessary forms and blanks, not otherwise provided.

2. Organization and follow-up suggestions.

3. Circulars of instruction, prepared by specialists in the different subject-matter departments.

4. The personal services of the State Leader of Junior Extension Work and his assistants for helping in the organization, follow-up, and exhibit phases of the work in the field.

5. Suggestions by correspondence at all times to superintendents of schools, local leaders, and project workers, concerning any phase of the work.

ORGANIZATION OF THE WORK: PROCEDURE

The following is the general method suggested for starting home project work on either a school credit or a contest basis in any school or district:

1. The superintendent of schools shall notify the teacher or the local leader regarding the kind of work to be undertaken, and shall designate the home projects to be considered. A copy of this leaflet should be in the hands of the teacher or the leader.

2. The teacher or the local leader should then take up the work with the boys and girls, encourage them to undertake one of the projects, and notify

THE FOODS PROJECT IN A RURAL SCHOOL

When an interest in and a willingness to do the work are shown, the equipment is usually forthcoming

the Department of Rural Education, New York State College of Agriculture, Ithaca, New York, of the probable number of project workers so that the necessary number of project outlines and enrollment cards may be sent at once.

3. Each pupil who is interested in the work should be given a copy of the project outline and an enrollment card to take home, where he should thoroly discuss the work with his parent. If the parent's consent is obtained, the pupil should fill out the enrollment blanks, which, after being signed by the parent, are to be returned to the teacher or the local leader.

4. The teacher or the local leader shall send the enrollment cards to the Department of Rural Education, New York State College of

Agriculture, Ithaca, New York. A record, in duplicate, of those taking up the work should be made as a check against possible error. The extra copy should be given to the superintendent of schools.

5. On receipt of the enrollment cards the College of Agriculture will send preliminary instructions for starting the work both to the pupils and to the teacher or the local leader. These will be followed by others from time to time, dealing with the progressive development of the project.

6. The College of Agriculture will also supply the project workers with the record books in which to keep a labor and financial account of their work. It is important that the records be both accurate and complete as they will form the basis of the district superintendent's recommendation

THE FOODS PROJECT IN A RURAL HIGH SCHOOL

that academic credit be given for the credit project work, or will count for at least a possible twenty points in the basis of awards for all contest work.

THE HOME PROJECT PROGRAM

Because of the educational character of the home projects and the seasonal study requirements of much of the work, a program covering the entire year or all phases of the work, is necessary. The nature of the program will vary according to the kind of project, the season of the year, and the dominant interests of the boys and girls. Suggestive topics for the group study and discussion are given as a part of each project outline.

Three phases of the home project work are to be noted, each calling for a somewhat different method of development and supervision. They are:

(1) the home work; (2) the school-directed study, including laboratory and field demonstrations; and (3) the social or supervised play activities centering around and growing out of the first two phases.

A CLOTHING PROJECT GROUP

The Youngsville, Sullivan County, clothing project workers and specimens of their handicraft

1. The home work, of course, is the most important feature of any project, for it requires the greatest and most sustained effort on the part of the boy or the girl.

2. There should be enough study, discussion, and demonstration associated with each project to insure that the work will be done intelligently and in a businesslike manner. A certain minimum amount of school-directed study will be required in all of the project work undertaken for academic credit.

In connection with the study phases of the work, many free bulletins and pamphlets may be obtained that contain useful information pertaining to the project. A list of such publications is not given in this leaflet because new ones are constantly appearing and the old ones are going out of print. The best of the available publications from the College and the United States Department of Agriculture will be sent directly to the project workers, or will be mentioned in the project circulars.

The topics suggested for study and discussion in each project outline are not limited to the time or the titles indicated, but are to be studied and the work done whenever the material is available and the occasion demands. Many topics other than those listed may be studied with profit.

3. The social or play features, such as the regular group meetings at the school, picnics, excursions, hikes, play festivals, and the like, are to be emphasized in both the credit and the contest work. Such activities help to sustain the interests of the boys and girls and provide a wholesome basis for cooperative efforts thru which may be developed a social consciousness, freedom and ease in oral expression, and some of the latent leadership ability that otherwise may lie dormant.

PRIZES

The giving of prizes the value of which is disproportionate to the efforts required on the part of the boys and girls, is to be discouraged. This should not prevent suitable cash and honorary awards from being given for all junior project work on a contest basis, however, as the natural fruition of the contest is a fair or an exhibition at which suitable recognition is given to the contestants who have entered the best exhibits or who have made the best records. The fundamental principle governing the awarding of prizes to boys and girls is that each individual who participates in a contest, meets all the requirements, and carries thru his work to the best of his ability, should be given recognition of some kind.

When cash awards are given, there should be only a slight difference in the amounts available for first, second, and third prizes, and there should be as many cash prizes of equal amounts in the third class as possible, the idea being to recognize all individuals who have scored above fifty or sixty points out of the possible one hundred. Honorary ribbon awards or gold or silver achievement or service emblems should be the distinctive prizes given to first and second place winners, while all the remaining contestants who have done meritorious work should each receive a special ribbon award or a bronze or enameled pin or button.

Short educational trips or scholarships for free attendance at a summer session or a winter course held at the College of Agriculture or at the nearest State School of Agriculture are advisable and permissible when they are awarded as a special prize to the individual making the best record in a town, supervisory district, or county contest. Such awards will have the greatest educational value when given to a project worker as a reward for having made an extra good record during two or more successive seasons.

Distinctive arm-bands, shields, and emblems have been designed for the special use of the junior project workers, and all those in charge of contest work are urged to set aside some of their premium money for the purchase of awards of this character.

DIVISIONS OF EACH PROJECT

In all the home project work undertaken on a contest basis it is suggested that the boys and girls be divided into three classes according to their ages, so that there will be a more equitable basis for competition. Members of an older class should not be permitted to compete with those belonging to a younger class, altho nothing should prevent the younger boys and

girls from competing in a more advanced class. The junior home project work is limited to those who are under twenty years of age.

The class divisions suggested are as follows:

Class A. Ages up to 11, inclusive
Class B. Ages 12 to 15, inclusive
Class C. Ages 16 to 19, inclusive

GENERAL REQUIREMENTS

1. Only those home projects or divisions thereof that have been approved by the superintendent of schools concerned, should be undertaken.

A WESTFIELD RURAL-SCHOOL-DAY MEETING
Some of these pupils traveled five to ten miles to attend such meetings each month

2. Boys and girls should obtain the consent of their parents or guardians before enrolling for any junior home project. The enrollment card is to be filled in by the prospective project worker, signed by the parent or guardian, and returned to the teacher or the local leader.

3. Project workers are requested to save and study all the circulars sent to them pertaining to the project and to follow the instructions of the teacher or the person acting as the local leader.

4. Project workers should keep an accurate and up-to-date record of their work, using the special project report booklets sent to them for that purpose. The project reports are to be sent to the superintendent of schools at the close of the work or sooner if called for.

5. Project workers shall make an exhibit of their work at such time and place as may be called for by those in charge of the work. The exhibit should be the result of the exhibitor's unaided efforts.

SPECIAL REQUIREMENTS FOR ACADEMIC CREDIT

The special requirements for academic credit, as prescribed by the State Department of Education for junior home project work, are as follows:

1. A boy or a girl may receive academic credit to the extent of one Regents' count in any given year for the completion of a junior home project. Not more than two Regents' counts, for the completion of two junior home projects, will be granted an individual.

2. The project worker shall be above the sixth grade in the public schools or twelve years of age or older. High school students who have enrolled in a vocational course in agriculture or home making may not undertake junior home project work for credit.

3. At least thirty-six periods of forty-five minutes each, or an equivalent amount of time, shall be devoted to the study of the junior home project under the direction of a person designated by the superintendent of schools.

4. The home project shall be visited or the work shall be inspected at least three times during the period the project is in progress (preferably at the beginning, during, and at the end of the work) by the superintendent of schools or some person designated by him.

5. A complete and accurate report, including the labor and cash record of the project, shall be presented to the superintendent of schools when the work is finished.

6. The home work must meet the minimum requirements prescribed for Class B or C in the projects outlined in this leaflet.

7. The Regents' count granted for the completion of a junior home project will be credited on the official records when the project worker has actually been enrolled in a high school in New York State, on the certification of the superintendent of schools of the district wherein the work was done to the Commissioner of Education that such credit is due.

SCHOOL-DIRECTED STUDY REQUIREMENTS

The school-directed study requirements of the credit project work may be met in any one or a combination of two or more of the following ways:

1. One forty-five-minute period or three fifteen-minute periods per week, or an equivalent amount of time each month, may be devoted to the study of the project circulars and references, either at school or at home but

directed by the teacher, to the discussion in school of the project topics or of the experiences of the students, to demonstrations by the leader or others at school or in the field relating to the project. Such work will be easier to direct and supervise if all the pupils undertake the same kind of project. As a rule not more than one agricultural project and one home-making project should be undertaken in a school during a given period. When different projects are represented in the same school, different periods should be assigned for the consideration of each.

2. If a rural school program does not permit the use of any time for project study and discussion, arrangements may be made thru the district superintendent whereby the project workers are allowed to attend a neighboring high school maintaining a vocational department or a director of agriculture or home making, and there receive half- or whole-day instruction once or twice each month.

3. The vocational instructor may so arrange his or her regular teaching schedule that one or more afternoons each week can be spent in the field organizing and giving instruction in the project work undertaken in the neighboring rural schools and visiting the project workers in their homes.

4. The project worker may present a notebook containing a written report on his or her work. If, in the estimation of the superintendent of schools, the notebook shows evidence of systematic study, originality in expression, and intelligent preparation, and has required for its preparation at least the minimum amount of time specified for school-directed study, the notebook may be accepted as satisfying those requirements. All such notebooks should follow, in a general way, the outline of topics dealing with the project as given in this leaflet.

THE SCHOHARIE COUNTY LIVESTOCK CLUB

This work was fostered by the Schoharie County Breeders' Association, the Schoharie County Farm Bureau, and the Cobleskill State School of Agriculture

THE FOODS PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages........................	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the making of twenty loaves of wheat or wheat-saver bread and five pans of quick breads, during a contest period of four months. An exhibit of one loaf of yeast bread and one small pan of quick bread, not more than twenty-four hours old, may be required.

B. Class B requires the study, home preparation, and use of a certain group of foodstuffs. The home work shall be as follows:

1. Cooking meat or meat-savers eight times. Meat-savers should be used as many as four times.

2. Use of milk six times, and milk in combination with eggs and cheese six times.

3. Making wheat-saver yeast breads eight times, and quick breads four times.

4. Cooking vegetables twelve times. This shall include rice, beans, potatoes, and at least one other vegetable.

5. Canning three jars of fruit (at least two fruits) and three jars of vegetables (at least two vegetables).

C. Class C requires the study and home application of the various methods in common use for preserving foodstuffs by canning, drying, salting, and the like. The home work shall include the following:

1. Canning at least ten quarts of fruit.
2. Canning at least ten quarts of vegetables.
3. Drying at least one pound of vegetables or fruit (weighed after drying).
4. Salting or fermenting one-half gallon of vegetables.
5. Canning at least five quarts of meat, poultry, fish, or soup stock.

6 (optional). Preserving at least five dozen eggs in water glass.

BASIS OF AWARDS

CLASS A

Best loaf of wheat-saver bread..............................	40
Best exhibit of quick bread..............................	40
Best story, *How I Made My Bread*..............................	20
Possible score..............................	100

CLASS B

Best exhibit of canned goods (1 pint jar each of a fruit and a vegetable)..............................	30
Best exhibit of breadstuffs (1 loaf of wheat-saver yeast bread, 1 loaf of quick bread, or one-half dozen muffins or biscuits)..	30

CLASS B (*continued*)

Best exhibit of prepared dish representing group 1, 2, or 3	20
Best record of project work	20
Possible score	100

CLASS C

Best exhibit of canned vegetables (3 pint jars, different varieties)	20
Best exhibit of canned fruits (3 pint jars, different varieties)	20
Best exhibit of canned meat (three pint jars, different kinds)	20
Best exhibit of dried vegetables or fruit (1 pint jar of each)	20
Best record of project work	20
Possible score	100

SUGGESTED TOPICS FOR STUDY AND DISCUSSION

CLASS B

1. The use of food in the animal body.
2. The nature and function of the different food substances: fats, carbohydrates, proteins, water, ash.
3. The purpose and use of heat in food preparation.
4. The place of water and watery substances in the diet.
5. Sanitation in food preparation.
6. Methods of preserving foodstuffs.
7. Food requirements at different ages.
8. The nature, preparation, and use of the following food materials: sugar; starch—potatoes, cereals, legumes; milk products; eggs; meats—beef, mutton, pork; poultry, fish, oysters; fats and oils; gelatin; flour and flour products.
9. The selection of food.
10. Serving food.
11. Eliminating kitchen drudgery.

CLASS C

1. Methods of food preservation.
2. Why foods spoil.
3. The life history of bacteria. Yeasts; molds.
4. Preserving food by cold storage.
5. Preserving food by drying.
6. Preserving food by heat sterilization.
7. Use of sugar in food preservation.
8. Preserving food by fermentation.
9. Preserving food by salting.

CLASS C (*continued*)

10. Preserving eggs in water glass.
11. Canning powders. Their harmful effects.
12. The open-kettle method of canning.
13. The cold-water process.
14. The cold-pack method:
    - a. Hot-water bath: continuous sterilization; intermittent sterilization.
    - b. Steam pressure.
15. Equipment needed for home canning.
16. Canners:
    - a. Hot-water bath.
    - b. Steam pressure.
17. Canning for market in tin.
18. Canning meats, soup stock, and other animal products.
19. Canning fruit juices.
20. Quality in canned products.

REFERENCES

At least one of the following books should be available in the school library:

A study of foods. Ruth A. Wardall and Edna N. White. Ginn and Company.

Food and health. Helen Kinne and Anna M. Cooley. The Macmillan Company.

Household science and arts. Josephine Morris. American Book Company.

Food products. Henry C. Sherman. The Macmillan Company.

Foods and household management. Helen Kinne and Anna M. Cooley. The Macmillan Company.

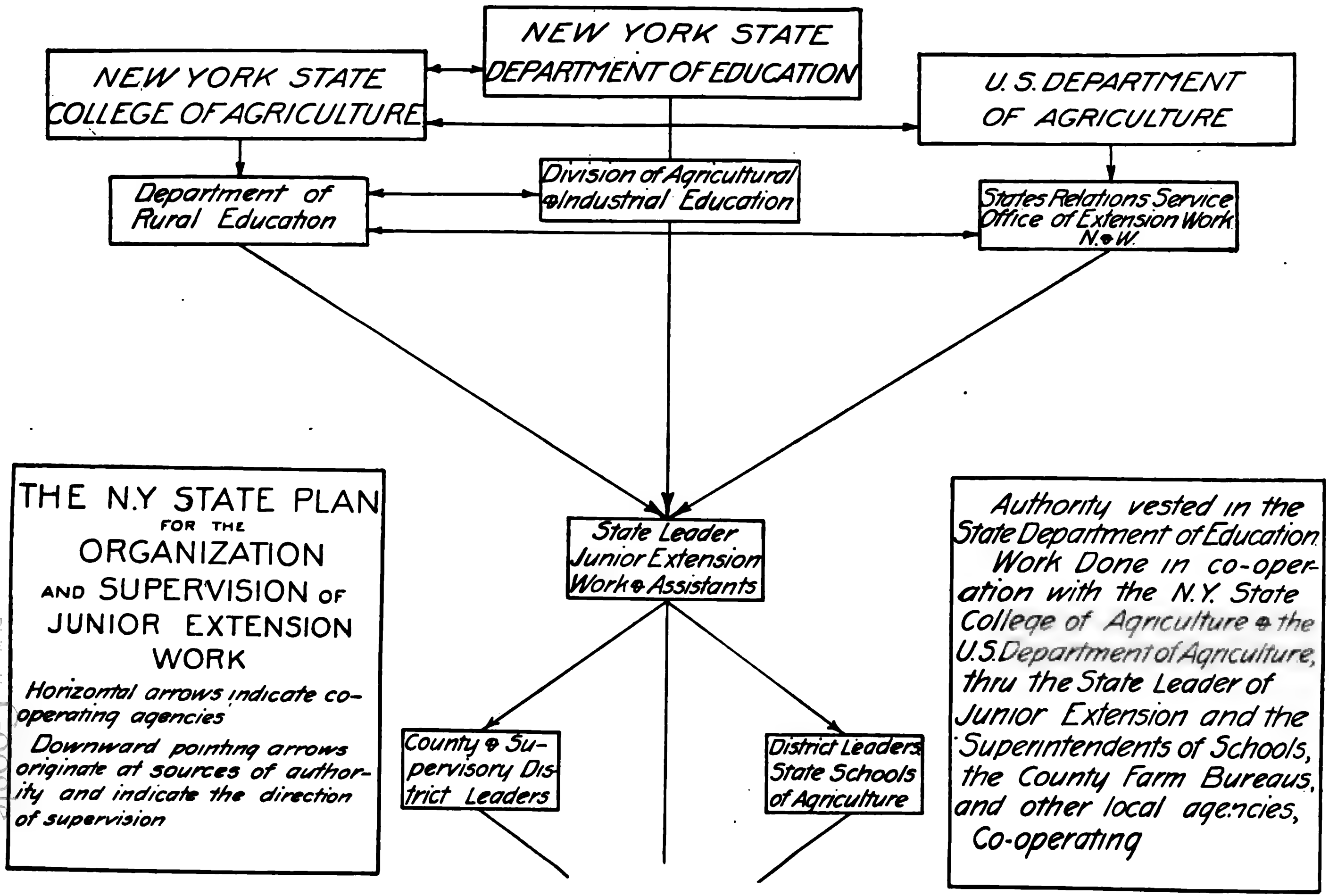
Elements of the theory and practice of cookery. Mary E. Williams and Katharine R. Fisher. The Macmillan Company.

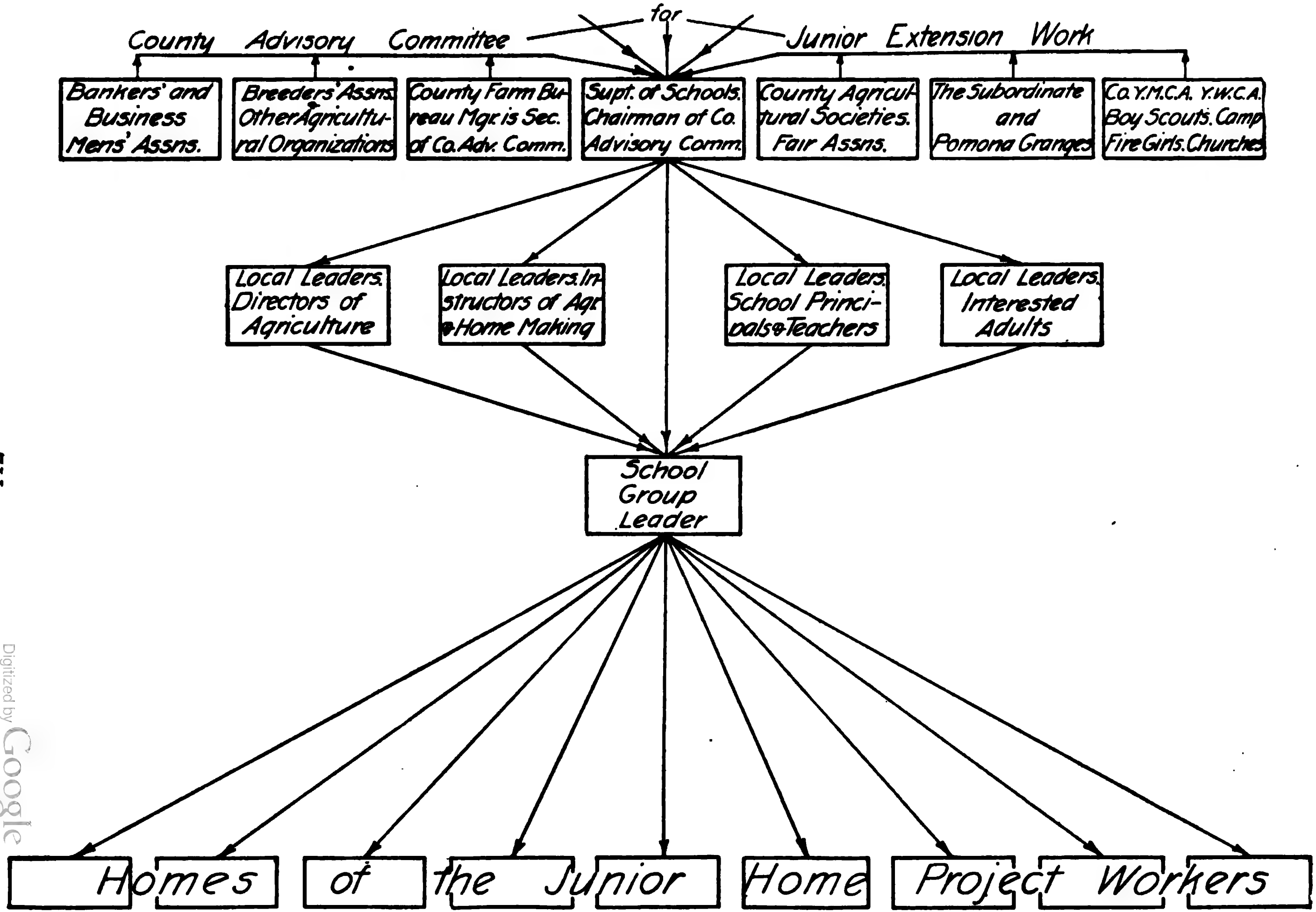
THE CLOTHING PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages........................	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the darning and mending of four pieces of wearing apparel, and the exhibition of the mended garments at such time and place as may be decided by the teacher or those in charge of the contest.


NEW YORK STATE COLLEGE OF AGRICULTURE
NEW YORK STATE DEPARTMENT OF EDUCATION
U. S. DEPARTMENT OF AGRICULTURE
Department of Rural Education
Division of Agricultural & Industrial Education
States Relations Service Office of Extension Work N. & W.
State Leader Junior Extension Work & Assistants
County & Supervisory District Leaders
District Leaders State Schools of Agriculture
THE N.Y STATE PLAN FOR THE ORGANIZATION AND SUPERVISION OF JUNIOR EXTENSION WORK
Horizontal arrows indicate co-operating agencies
Downward pointing arrows originate at sources of authority and indicate the direction of supervision
Authority vested in the State Department of Education
Work Done in co-operation with the N.Y. State College of Agriculture & the U.S. Department of Agriculture, thru the State Leader of Junior Extension and the Superintendents of Schools, the County Farm Bureaus, and other local agencies, Co-operating


County Advisory Committee for Junior Extension Work
Bankers' and Business Mens' Assns.
Breeders' Assns. & Other Agricultural Organizations
County Farm Bureau Mgr. is Sec. of Co. Adv. Comm.
Supt. of Schools. Chairman of Co. Advisory Comm.
County Agricultural Societies. Fair Assns.
The Subordinate and Pomona Granges
Co. Y.M.C.A. Y.W.C.A. Boy Scouts. Camp Fire Girls. Churches
Local Leaders. Directors of Agriculture
Local Leaders. Instructors of Agr. & Home Making
Local Leaders. School Principals & Teachers
Local Leaders. Interested Adults
School Group Leader
Homes of the Junior Home Project Workers

B. Class B requires the completion of the following articles:

Handwork. Hemming a towel or a table napkin; making six buttonholes; sewing on six buttons; basting for machine work where necessary.

Machine work. A kitchen holder; a kimono apron to cover dress; a corset cover, a princess slip; a chemise or bloomers; a nightgown or a kimono.

Repair work. Darning six pairs of stockings; patching an apron and an undergarment.

C. Class C requires the completion of the following articles:

Handwork. A dainty apron and a collar.

Machine work. A middy blouse; a waist or a skirt; a one-piece wash dress.

Repair work. Mending a woolen garment, one pair of cotton, silk, or kid gloves, and one fine garment.

BASIS OF AWARDS

CLASS A

Best exhibit of darning and mending (4 different specimens)	75
Best story (100 words or more), *A Stitch in Time Saves Nine*	25
Possible score	100

CLASS B

Best exhibit, one specimen of handwork	25
Best exhibit, one specimen of machine work	25
Best exhibit, one specimen of repair work	25
Best report on the project work	25
Possible score	100

CLASS C

Best exhibit, one specimen of handwork	25
Best exhibit, one specimen of machine work	25
Best exhibit, one specimen of repair work	25
Best report on the project work	25
Possible score	100

SUGGESTED TOPICS FOR STUDY AND DISCUSSION

1. The evolution of sewing. Primitive methods. Modern methods.
2. The evolution of weaving from ancient to modern times.
3. Kinds, history, and manufacture of needles, pins, thimbles, scissors.
4. The evolution of the sewing machine.

5. The manufacture of cotton cloth. Uses. Tests for quality, color, and adulteration.

6. The manufacture of flax cloth. Uses. Tests for quality, color, and adulteration.

7. The manufacture of wool cloth. Uses. Tests for quality, color, and adulteration.

8. The manufacture of silk cloth. Uses. Tests for quality, color, and adulteration.

9. Kinds and uses of the different stitches: running, basting, gathering, hemming, backstitching, combination stitch, overcasting, buttonhole stitch, fancy stitches.

10. Care of wearing apparel. Laundering, ironing, pressing, mending, removal of stains.

11. Renovation of clothing. Altering. Dyeing.

12. Wardrobe essentials. Necessary articles, necessary numbers. Clothing for warm and cold weather; work, house, business, recreation, reception dresses. Appropriateness, simplicity, good taste, fashions.

13. Art and beauty in dress. Designs suitable for persons of various heights and weights. Colors suitable for different types.

14. Hygiene of clothing.

REFERENCES

At least one of the following books should be available in the school library:

Clothing and health. Helen Kinne and Anna M. Cooley. The Macmillan Company.

School needlework. Olive C. Hapgood. Ginn and Company.

Textiles. Mary S. Woolman and Ellen B. McGowan. The Macmillan Company.

A sewing course. Mary S. Woolman. F. A. Fernald, Washington, D. C.

THE GARDEN PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive
Size of project	250 square feet	500 square feet	1000 square feet

A. Class A requires the contestant to do all the work, except plowing and similar heavy work, necessary for preparing, planting, and caring

for the garden thruout the season. At least three different kinds of vegetables are to be grown.

B and C. Class B and Class C require all the work necessary for preparing, planting, and managing a garden of at least the specified area during the season. At least eight different kinds of vegetables should be grown. Both intercropping and succession cropping should be practiced. The aim should be to have a constant supply of the most valuable vegetables thruout the season with an abundance of vegetables stored and canned or dried for winter use.

BASIS OF AWARDS

CLASS A

Best exhibit of vegetables	70
Best diary of garden work	30
Possible score	100

CLASSES B AND C

Best-planned and -managed garden	20
Best yield of garden products	20
Lowest cost of production	20
Best-kept records	20
Best exhibit of garden products (fresh, dried, and canned)	20
Possible score	100

Each garden should be visited several times during the season by the same person, if possible, so that improvements may be noted and credited.

SEASONAL TOPICS SUGGESTED FOR STUDY AND DISCUSSION

September...... Harvesting, canning, drying. Field study of typical gardens.

October........ Harvesting and storing. Field study of garden soils; collecting soil samples. Weed study and collection of specimens. Laboratory study of matured vegetables. Judging and scoring of exhibits.

November...... Vegetable groups: seasonal; structural. Market gardening. Truck-growing sections: climatic, soil, marketing, transportation, and other requirements.

December...... Forcing vegetables. Greenhouse management. Construction and use of hotbeds and coldframes.

January........ Garden planning: intercropping, succession cropping. Garden seeds: source, quality. Study of seed catalogs. Selection of varieties. Making garden plan to scale.

February.......	Study of home garden soil: kind; origin; texture; structure; organic matter; other physical characteristics.
March.........	Composition of plants. Plant-food elements. Fertilizers and manures; use and method of application. Test of the soil for acidity. Growing early plants for outdoor setting.
April..........	Seedbed preparation: principles; methods; cultural methods.
May...........	Planting and transplanting methods. Requirements for plant growth. How plants get their food and water.
June...........	Cultivation: object. Movement and control of soil moisture. Weeds and weed control. Vegetable pests and diseases: life history; control.
July...........	Marketing of fresh vegetables. Canning of vegetables: for home use; for sale. Drying and salting methods. Field study of growing plants. Structure and functions of leaves, stems, flowers, roots.
August.........	Field trips, picnics, and the like.

REFERENCES

At least one of the following books should be available in the school library:

Productive vegetable growing. John W. Lloyd. J. B. Lippincott Company.

Vegetable gardening. Ralph L. Watts. Orange Judd Company.

The manual of gardening. L. H. Bailey. The Macmillan Company.

THE POTATO PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages..........................	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive
Size of project....................	100 hills	$\frac{1}{8}$ acre	1 acre

A. Class A requires the contestant to do all the work, except plowing and similar heavy work, necessary for growing 100 hills of potatoes. The seed should be planted by the tuber-unit method, and the best hills should be selected and saved for seed at digging time.

B and C. Class B and Class C require all the work necessary for growing the specified area of potatoes. The aim should be to produce the largest crop possible at the lowest cost, to hill-select the seed in the

field, and to perpetuate the best hills by the hill-to-row method. When starting with non-selected seed, a portion of the plat should be planted by the tuber-unit method.

BASIS OF AWARDS

CLASS A

Best lot of tubers produced by one potato plant	80
Best diary telling of work	20
Possible score	100

The potatoes should be dug and the best hill selected by the contestant in the presence of some disinterested person who should certify to the number and relative sizes of the tubers. All the tubers in the selected hill are to be placed and securely tied in a cloth or paper sack, where they are to remain until opened by the person in charge of the contest exhibit.

It would be easier to have the exhibit consist of a plate of five or ten selected tubers, but the educational value and the economic importance of seed selection justify the extra work involved in an exhibit of this nature.

CLASS B AND CLASS C

Highest yield	30
Lowest cost of production	30
Best-kept records	20
Best exhibit of one peck of market tubers	20
Possible score	100

The yield may be determined by either of two methods: (1) The plat should be dug and the crop weighed in the presence of a disinterested person. (2) When the potatoes are harvested, every fifth row (or multiple thereof) should be left undug. The contestant will estimate his yield from the hills that have been dug and report immediately to the local leader. On a day appointed by the leader, the five or six contestants reporting the highest yields will meet together with the leader to dig the remaining rows on each of their respective plats and in this manner verify the yields.

SEASONAL TOPICS SUGGESTED FOR STUDY AND DISCUSSION

September... Field study of matured potato plant. Root development; arrangement of tubers. The stand. Potato diseases and pests.

October..... Characteristics of good potato plants. Field selection of seed. Harvesting and storage. Marketing. Field study of the soil; collection of samples. Field study and collection of weeds.

November....	Study of potato tubers: botanical characteristics. Types and varieties of potatoes. Judging potatoes; use of score card.
December...	Potato by-products. Culture, use, and value of the crop in European countries.
January......	History of the potato plant. Potato-growing sections: yields and value of crop; climatic and soil requirements.
February....	Laboratory study of the soil of the home farm: origin; texture; structure; humus content.
March......	Composition of the potato plant. Plant-food elements. Farm manures; commercial fertilizers; soil amendments.
April........	Seedbed preparation: principles of tillage; methods; implements.
May........	Selection of seed. Varieties. "Sprouting." Potato tuber diseases: treatment. Cutting of seed; planting; method; rate; depth. Requirements for plant growth: heat; light; air; moisture; food.
June........	How plants get their food and water: from the seed; from the soil; from the air. Principles of cultivation: moisture control; weed control.
July........	Potato pests and diseases: life history; control. Field study of the growing plant: structure and function of roots, stems, leaves, flowers, tubers.
August......	Field trips, hikes, and the like.

REFERENCES

One or both of the following books should be available in the school library:

The potato. A. W. Gilbert. The Macmillan Company.

The potato. E. H. Grubb and W. S. Guilford. Doubleday, Page & Company.

THE CORN PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages..........................	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive
Size of project.....................	100 hills	$\frac{1}{8}$ acre	1 acre

A. Class A requires the contestant to do all the work, except plowing or similar heavy work, necessary to grow 100 hills of field corn.

B and C. Class B and Class C require all the work necessary to grow at least the prescribed area of field, pop, or sweet corn. The aim is to grow

the largest possible crop at the lowest cost, to select the seed in the field, to perpetuate the best ears by the ear-to-row method, and to keep accurate cash and labor records.

BASIS OF AWARDS

CLASS A

Best specimen of corn plant, ears and roots intact	80
Best story of work done	20
Possible score	100

The contestant should select the best specimen of a corn plant, bearing the most matured and perfect ear, of those grown on his plat. This plant should be carefully stored and at the proper time delivered to the person in charge of the contest exhibit. The exhibit phases of this contest may be simplified by making the exhibit consist of five or ten ears, but the educational value and the economic importance of seed selection justify the extra work and attention required of an exhibit of the nature specified.

CLASS B AND CLASS C

Highest yield	30
Lowest cost	30
Best-kept records	20
Best exhibit of ten ears	20
Possible score	100

The exact area of the corn plat should be determined by the local leader and certified by him. The yield may be determined by either of two methods: (1) The plat should be harvested and the corn weighed in the presence of a disinterested person. (2) When the corn is harvested, every fifth row (or multiple thereof) should be left unhusked and standing in the field, or, if cut, gathered into separate shocks in the field. The contestant will estimate his yield from the husked corn and report immediately to the local leader. On a day appointed by the local leader, the five or six contestants reporting the highest yields will meet together with the leader and husk out row five or multiple thereof on each of their respective plats and in this manner verify the yields. The samples of the five highest yields should be tested for the moisture content.

SEASONAL TOPICS SUGGESTED FOR STUDY AND DISCUSSION

September... Field study of matured corn plant. The stand. Characteristics of a good parent plant. The yield. Field selection of seed.

October..... Harvesting of corn. Making and use of ensilage. Diseases and pests. Field study of the soil. Collection of good and poor specimens of corn plants (roots intact).

November... Laboratory study of the corn ear. Types and varieties of corn. Corn judging. Use of score card.

December... Study of the corn kernel: its structure. Farm uses of the corn kernel. Commercial uses of the corn kernel. Corn by-products.

January..... History of the corn plant. Corn-growing sections. Yields. Value of the crop. Climate and soil requirements.

February.... Laboratory study of the soil of the farm: kind; origin; texture; structure; humus content.

March...... Composition of the corn plant. Plant-food elements: farm manures; commercial fertilizers; soil amendments.

April........ Seedbed preparation for corn. Tillage; principles; methods. Selection and testing of seed corn.

May........ Planting: method; rate; depth. Physical requirements for plant growth: heat; light; air; moisture; food.

June........ How plants obtain their food and water: from the seed; from the soil; from the air. Principles of cultivation: moisture control; weed control.

July........ Corn pests and diseases: life history; control methods. Field study of the growing plant: structure and functions of roots, stems, leaves. How corn plants reproduce: function of tassel, pollen, silk.

August...... Field trips, hikes, and the like.

The topics suggested are not limited to the months indicated but are to be studied or the work done whenever the material is available or the occasion demands. Many seasonal topics other than those listed above may be studied with profit.

REFERENCES

At least one of the following books should be available in the school library:

Corn. M. L. Bowman and B. W. Crossley. Published by the authors.

The corn crops. E. G. Montgomery. The Macmillan Company.

The cereals in America. Thomas F. Hunt. Orange Judd Company.

THE BEAN PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive
Size of project	200-foot row	$\frac{1}{8}$ acre	1 acre

A. Class A requires all the work necessary, except plowing and similar heavy work, for growing at least 200 linear feet of beans, together with a report of the work and an exhibit.

B and C. Class B and Class C require all the work necessary for growing the specified area of beans. The aim should be to produce the largest possible crop at the lowest possible cost, to select the earliest maturing, heaviest yielding, and healthiest bean plants in the field before harvest, and to perpetuate the best plants by planting the seed from each selected plant in separate rows and again selecting and saving the best seed the succeeding year.

BASIS OF AWARDS

CLASS A

Best bean plant	80
Best diary of work done	20
Possible score	100

The highest yielding, most mature, and healthiest bean plant, pods and roots intact, produced on the contestant's plat, should be selected by him. This plant should be carefully stored until called for by the person in charge of the contest exhibit. The reasons for this kind of an exhibit are explained under the potato and corn projects.

CLASS B AND CLASS C

Highest yield	30
Lowest cost of production	30
Best-kept records	20
Best exhibit (1 peck of shelled beans)	20
Possible score	100

The yield may be determined by either of two methods: (1) The crop should be harvested, threshed, and weighed in the presence of some disinterested person. (2) When the beans are being harvested, every fifth row (or multiple thereof) should be left in separate rows or piles. The contestant will estimate his yield from the rows that have been harvested and report immediately to the local leader. On a day appointed by the leader, five or six contestants reporting the highest yields will meet together

with the leader and thresh row five on each of their respective plats and in this manner verify the yields.

SEASONAL TOPICS SUGGESTED FOR STUDY AND DISCUSSION

September...	Field study of matured bean plants. The stand. Characteristics of good and poor plants. Field selection of seed. Diseases and pests.
October.....	Methods of harvesting, marketing, and storing beans. Field study of bean soils; collection of soil samples. Field study and collection of weeds.
November...	Bean varieties and types. Bean judging and scoring.
December...	History of the bean plant. Economic importance. Distribution. Yields. Value.
January.....	Bean-growing sections in New York. Varieties. Climatic and soil requirements.
February....	Soil study of the home farm or community: origin; texture; structure; other physical characteristics.
March......	Chemical composition of the bean plant. Plant-food elements: farm manures; commercial fertilizers; soil amendments. Tests for acidity of the soil.
April........	Seedbed preparation: principles of tillage; methods; implements.
May........	Selection of seed. Requirements for growth: heat; air; light; moisture; food.
June........	Planting: methods; rate; depth. How plants get their food and water: from the seed; from the soil; from the air. Principles of cultivation: moisture control; weed control.
July........	Bean pests and diseases: control. Field study of the growing plant: roots, stems, leaves, flowers.
August......	Field trips, hikes, and the like.

REFERENCES

The following book should be available in the school library:
Bean culture. Glenn C. Sevey. Orange Judd Company.

THE POULTRY PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages...........................	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the hatching and rearing of one brood of purebred chickens (setting of 15 eggs). The contestant should enroll not later than March 1.

B. Class B requires the hatching and rearing of at least two broods of purebred chickens (setting of 15 eggs each), and the management of the chicks for a period of six months. The contestants should enroll and start the project work not later than March 1.

C. Class C requires the care and management of twelve or more purebred pullets or old hens for a period of at least six months. The contestants should enroll and start the project work not later than October 1.

BASIS OF AWARDS

CLASS A

Best exhibit of one pair of fowls raised by the contestant	80
Best diary of work done	20
Possible score	100

CLASS B

Pounds gain per fowl raised	30
Cost of production per fowl raised	30
Exhibit of one pen of fowls	20
Best record of work done	20
Possible score	100

The rate of gain for each breed shall be in proportion to the Standard weights for that breed, which are as follows for a few of the more common breeds:

	Cocks (pounds)	Cockerels (pounds)	Hens (pounds)	Pullets (pounds)
Leghorns	5½	4½	4	3½
Plymouth Rocks	9½	8	7½	6
Wyandottes	8½	7½	6½	5½
Rhode Island Reds	8½	7½	6½	5

The exhibit is to consist of one male and three females selected by the contestant from his flock.

CLASS C

Value of eggs laid per fowl	30
Cost of production per fowl	30
Exhibit of one pen of fowls	20
Best record of work done	20
Possible score	100

The exhibit is to consist of one male and three females selected by the contestant from his flock.

SEASONAL TOPICS SUGGESTED FOR STUDY AND DISCUSSION

September...... Housing and yarding of pullets. Essentials of equipment. Sanitation. Poultry diseases and pests.

October........ Feeding for eggs. Food requirements of fowls. Balanced rations.

November...... External characteristics of fowls: general; detailed. Fitting fowls for an exhibit. Judging poultry. Use of score card.

December...... Types and breeds. History of the domestic fowl. Importance of the poultry industry: to the community; to the State; to the nation.

January........ Poultry breeding. Building up a laying strain.

February....... Formation and structure of the egg. Homemade appliances for hatching and rearing chicks.

March......... Natural and artificial incubation. Selection and caring for eggs for hatching. Methods of marketing eggs.

April........... Natural and artificial brooding. Feeding and rearing of chicks. Enemies and diseases of chicks.

May............Testing eggs for interior quality: methods. Preserving eggs in water glass: method.

June........... Rearing pullets.

July........... Culling young and mature stock. Fattening and marketing of poultry.

August......... Field trips, hikes, and the like.

REFERENCES

At least one of the following books should be available in the school library:

Poultry production. W. A. Lippincott. Lea and Febiger.

Poultry husbandry and management. James Dryden. Orange Judd Company.

Productive poultry husbandry. H. R. Lewis. J. B. Lippincott Company.

Farm poultry. J. H. Robinson. Farm Poultry Publishing Company.

Feeds and feeding (abridged). W. A. Henry and F. B. Morrison. The Henry-Morrison Company.

THE CALF PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages..........................	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the care of a grade or a purebred heifer calf for a period of six months. The calf should not be more than six months old at the time the work is started. The contestant should enroll not later than March 1. The calf is to be exhibited at the close of the contest, the time and place to be designated by the local committee in charge of the contest.

B. Class B requires the care and management of a heifer calf (purebred if obtainable) of any dairy breed for a period of twelve months. The calf should not be more than six months old at the beginning of the project. It is to be exhibited at such time and place as may be designated by the committee in charge of the contest.

C. Class C requires the care, management, and breeding of a heifer (purebred if obtainable) of any dairy breed for a period of twelve months. The heifer should be between twelve and eighteen months old when the project is started, and she is to be bred so as to freshen before the contest is ended but preferably not before she is two years old. Both cow and calf are to be exhibited at such time and place as may be designated by the committee in charge of the contest.

Boys and girls who wish to undertake any division of this project but who are unable to obtain a heifer calf, will be helped by means of the promissory note plan described on page 369.

BASIS OF AWARDS

CLASS A

Best calf, breed considered..................................	80
Best and most complete diary of work done.................	20
Possible score..................................	100

CLASS B

Best calf, breed considered..................................	20
Greatest average daily gain in weight......................	30
Lowest cost of production..................................	30
Best-kept records..................................	20
Possible score..................................	10[illegible]

CLASS C

Best cow and calf, breed considered: cow, 30; calf, 20	50
Ability in judging and placing cows in the show ring	25
Best-kept records	25
Possible score	100

SUGGESTED TOPICS FOR STUDY AND DISCUSSION

1. Feeding the dairy calf.
2. Management of dairy heifers.
3. Diseases of calves and their control.
4. Breeding and management of dairy cows.
5. Selection of the dairy sire.
6. Dairy "queens" and "kings." Milk and fat production records; their value.
7. Breeding for milk production. The Registry of Merit.
8. Breeds of dairy cattle. Origin and development.
9. The housing of dairy cattle. Sanitation.
10. Conserving the health of dairy cows.
11. Classes of feeding stuffs: concentrates; roughage; succulents.
12. Dairy feeding stuffs used locally: kinds; source; value.
13. Composition of animal foods: carbohydrates; fats; protein.
14. Use of the different food constituents in the animal body.
15. Balanced rations.
16. Process of digestion in ruminants.
17. The conformation of dairy cattle.
18. Use of the score card in judging.

REFERENCES

At least one of the following books should be available in the school library:

Dairy farming. C. H. Eckles and G. F. Warren. The Macmillan Company.

Productive dairying. R. M. Washburn. J. B. Lippincott Company.

Dairy cattle and milk production. C. H. Eckles. The Macmillan Company.

The principles and practice of judging live-stock. C. W. Gay. The Macmillan Company.

Live stock judging and selection. R. S. Curtis. Lea and Febiger.

Feeds and feeding (abridged). W. A. Henry and F. B. Morrison. The Henry-Morrison Company.

THE COW-TESTING AND RECORD-KEEPING PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the keeping of the milk and feed records of one or more cows for a period of six months. The milk produced by each cow is to be weighed and the weights recorded at the evening's and the succeeding morning's milking, on a certain day each week. The nature and amount of feed consumed by each cow is likewise to be recorded for one day once each week.

B. Class B requires the keeping of detailed and accurate milk, fat, and feed records of one or more cows for a period of six months. The contestant should enroll for this work not later than October 15.

The records, which are to be kept on special blanks furnished for that purpose, are to include the following information:

1. Daily weights of milk from each cow by milkings.
2. Weekly tests of butterfat of each cow. The sample for testing should be a composite sample of the morning's and evening's milk of one day.
3. Kind and amount of the various feeds used. The record is to be based on weighing one day's feed each week.
4. A monthly summary of all the records.

C. Class C requires the keeping of detailed and accurate milk, fat, and feed records of three or more cows for their lactation periods; the study of the conformation of dairy cows; and a demonstration of the contestant's ability in judging and placing cows in the show ring. Class C work should begin when the first cow under test freshens and will end with the drying up of the last cow included in the test. The requirements for keeping the records are the same as those given under Class B.

BASIS OF AWARDS

CLASS A

Number of cows — 1 point for first cow, 5 points for each additional cow, but not to exceed	25
Records, completeness and neatness	50
Story, *How I Obtained My Records*	25
Possible score	100

CLASS B

Number of cows — 1 point for first cow, 3 points for each additional cow, but not to exceed	25
Completeness of records	25
Accuracy of records	25
Neatness of records	25
Possible score	100

CLASS C

Number of cows — 1 point for first cow, 2 points for each additional cow, but not to exceed	25
Records, completeness and accuracy	25
Diary describing the work done	25
Ability in judging and placing dairy cows	25
Possible score	100

SUGGESTED TOPICS FOR STUDY AND DISCUSSION

1. Reasons for keeping milk, fat, and feed records.
2. Dairy "queens" of the different breeds. Their records.
3. The origin and value of the Babcock test.
4. Reasons for the fat variation in milk.
5. The constituents of milk.
6. Food value of milk and its products.
7. Bacteria in milk: kinds; effects on products.
8. Sanitation in milk production.
9. Uses of milk and its products.
10. Kinds of dairy feed used in the community.
11. Classes of dairy feeding stuffs: concentrates; roughage; succulents.
12. Composition of animal feeds: carbohydrates; fats; protein; ash; water.
13. Function of the different food constituents in the animal body.
14. Balanced rations for dairy cows.
15. The process of digestion in ruminants.
16. Housing and health of dairy cows.
17. Importance of the dairy industry in the locality, the county, the State, the nation.
18. Practical problems in dairy arithmetic.

REFERENCES

At least one of the following books should be available in the school library: (Also see the list on page 363.)

Milk and its products. Henry H. Wing. The Macmillan Company.

The feeding of animals. Whitman Howard Jordan. The Macmillan Company.

Feeds and feeding (abridged). W. A. Henry and F. B. Morrison. The Henry-Morrison Company.

THE PIG PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the feeding and care of one pig for a period of six months. The animal should not be more than ten weeks old when the project is started. The work should be started not later than May 1.

B. Class B requires the feeding and care of one or more pigs for a period of six months. The animals should not be more than ten weeks old when the work is started. Each project member shall provide at least one-eighth acre of good pasture for each pig, and raise, if possible, a small plot of grain (one-eighth acre of corn is suggested) for finishing and fattening the pig. The work should be started not later than May 1.

C. Class C requires the feeding, care, and management of a purebred gilt or sow and of her pigs for a period of at least six months. The sow should be bred to a registered boar so as to farrow, if possible, shortly after the the contest begins. An abundance of good pasture should be provided and a small plot of grain (one-half acre of corn is suggested) should be planted for finishing the market pigs in the fall. The work should be started not later than May 1.

Boys and girls who wish to undertake any division of this project but who are unable to obtain pigs, will be helped by means of the promissory note plan described on page 369.

BASIS OF AWARDS

CLASS A

Best pig for market purposes	75
Best story, *How I Raised My Pig*	25
Possible score	100

CLASS B

Best hog for market purposes	20
Greatest daily gain in weight	30
Lowest cost of production	30
Best-kept records	20
Possible score	100

CLASS C

Best sow and litter, considering purpose they are to serve.....	20
Greatest average daily gain in weight per pig...............	15
Lowest cost of production, including care of sow from breeding period until pigs are weaned...........................	30
Highest percentage of pigs raised of total number farrowed...	15
Best-kept records..........................	20
Possible score.................................	100

SUGGESTED TOPICS FOR STUDY AND DISCUSSION

1. Selection of pigs for breeding or for market purposes.
2. Feeding and care of pigs after weaning.
3. Housing and management of pigs.
4. Selection of brood sow. Points to be considered.
5. Housing of the brood sow.
6. Feeding the brood sow before and after farrowing.
7. Care and management of the brood sow:
   a. Before breeding.
   b. After breeding.
   c. After farrowing.
8. Selection of the sire.
9. Care and management of the litter up to weaning time.
10. Importance of sanitation in raising pigs.
11. Diseases of swine and their control.
12. Types of hogs. Characteristics of each.
13. Breeds of swine. Characteristics and history of each.
14. Judging swine. Use of the score card.
15. Pasture crops for pigs.
16. Finishing and fattening of hogs. Kinds of feed. Value.
17. How and when to market hogs.
18. Butchering hogs. Curing the meat. Use of by-products.

REFERENCES

One or more of the following books should be available in the school library: (Also see the last three books in the list on page 363.)

Productive swine husbandry. George E. Day. J. B. Lippincott Company.

Manual of farm animals. M. W. Harper. The Macmillian Company.

THE SHEEP PROJECT

MINIMUM REQUIREMENTS

	Class A	Class B	Class C
Ages	Up to 11 inclusive	12 to 15 inclusive	16 to 19 inclusive

A. Class A requires the feeding and care of one lamb for a period of six months and the exhibition of the animal at such time and place as may be provided for by the committee in charge of the contest.

B. Class B requires the feeding, care, and management of a flock of four or more lambs for a period of at least six months. The best animal in each flock is to be exhibited at such time and place as may be provided for by the committee in charge of the contest.

C. Class C requires the feeding, breeding, and management of four or more purebred ewes and the care of their lambs for a period of twelve months, starting not later than November 1. The best ewe and lamb in each contestant's flock is to be exhibited at such time and place as may be provided for by the committee in charge of the contest.

Boys and girls desiring to undertake any division of this project but who are unable to obtain lambs or ewes, will be helped by means of the promissory note plan described on page 369.

BASIS OF AWARDS

CLASS A

Best lamb, breed considered	80
Story, *How I Raised My Lamb*	20
Possible score	100

CLASS B

Best lamb, breed considered	20
Greatest average gain in weight of flock	30
Lowest cost of flock management	30
Best record of work done	20
Possible score	100

CLASS C

Best ewe and lamb from flock, breed considered	20
Greatest gain in weight of flock (4 ewes and their lambs)	15
Best clip of fleece from flock	15
Lowest cost of flock maintenance	30
Best record of work done	20
Possible score	100

SUGGESTED TOPICS FOR STUDY AND DISCUSSION

1. Care and management of lambs after weaning.
2. Summer and fall management of the flock.
3. Winter and spring management of the flock.
4. The place of the sheep on the farm in New York State.
5. Types of sheep. Wool and mutton breeds.
6. Breeds of sheep. Adaptation to New York State conditions.
7. Establishing the farm flock: shelter; pasture.
8. Selection of the ram.
9. Management of the ram.
10. Selection of the breeding ewes.
11. Care of the ewes: before breeding; after breeding.
12. Special problems of flock management: dogs.
13. Sheep diseases and their control.
14. Care of the ewe at lambing time.
15. Weaning the lambs.
16. Docking the lambs.
17. Sheep-shearing methods.
18. Handling and marketing of the wool.

REFERENCES

One of the following books should be available in the school library: (Also see the last three books in the list on page 363.)

Sheep farming in North America. J. A. Craig and F. R. Marshall. The Macmillan Company.

Sheep farming in America. Joseph E. Wing. Sanders Publishing Company.

THE PROMISSORY NOTE PLAN

Boys and girls desiring to undertake any animal rearing project but unable to obtain the desired calf, pig, or sheep, may be assisted in getting the animal by means of the following plan:

On the recommendation of any member of the committee in charge of the work and by presenting a contract, properly signed by the contestant and the parent or the guardian, the bank or the banks represented on the committee will lend the contestant the amount necessary to pay for the animal. The loan is to be based on an ordinary promissory note, signed by the boy or the girl, endorsed by the parent or the guardian, and accompanied by the contract signed by the parent or the guardian. The note should run for a definite period (one year is suggested, with privilege of payment before maturity) and bear interest at 6 per cent.

When purebred animals are difficult to obtain locally, the committee in charge may purchase them outside the county or the State, and have

them shipped to some central place for distribution. The animals should be apportioned by lot, regardless of whether or not the actual purchase price or the average price of the shipment, is charged.

The animals should be insured in some reliable company, or each member may be assessed a sum sufficient, in the aggregate, to cover the loss of at least two by accident or sickness. When the members carry the risk themselves, the deposit will be returned in case of there being no loss. The insurance premium or assessment should be included in the amount covered by the note.

Older animals for breeding purposes may be procured for the contestants on the same basis as the younger ones. They should be bred to registered sires at such a time as to permit them to freshen, farrow, or lamb before the close of the contest. When supplied on the promissory note plan, the committee should supervise the breeding of the animals, the service fees to be included in the amount covered by the note.

Boys and girls have the privilege of paying off their notes at any time during the period of the contest. Those unable to raise the necessary funds or desiring to dispose of their animal under the most advantageous conditions, may do so according to the following plan:

On a date determined by the committee in charge of the contest, the animals of all the contestants desiring to take advantage of the auction sale plan of marketing may be brought to a central place, where they will be auctioned off to the highest bidder, every boy and girl, however, having the privilege of bidding in his or her own animal.

The representative of the bank or the banks making the loans should handle all the moneys resulting from the sale. After deducting from the amount received from each animal, the sum necessary to pay the note, the interest, the insurance, and a prorated share of other legitimate expenses, the remainder shall be banked to the credit of the boys and girls or paid to them in cash as may be preferred.

SUGGESTED FORM OF CONTRACT

It is hereby agreed by and between . . . ., party of the first part, and . . . . party of the second part, that the party of the first part shall lend to the party of the second part . . . . dollars at six per cent interest, principal and interest payable on or before one year after date.

It is further agreed that the major portion of this loan, amounting to . . . . dollars, shall be expended for the purchase of a pure-bred . . . ., said animal being acceptable to both parties of this contract. The minor portion of this loan, amounting to . . . . dollars, is to be used for the purchase of insurance or is to be deposited

as part of an insurance fund created for the protection of the note of any home project worker whose animal may die before the project is ended. (When the insurance fund plan is adopted, in case of there being no loss the deposit will be deducted from the amount of the note.)

It is also agreed that in the event of the animal being bred before the completion and as a feature of the project, the party of the first part shall designate the sire to be used and shall pay the service fees, these fees to be included in the face of the note. On the payment of said note, including the service fees, the party of the second part becomes sole owner of both the dam and the offspring.

The party of the second part agrees to maintain a membership in the district or county..................rearing project conducted according to the rules and regulations suggested by the New York State College of Agriculture at Cornell University in cooperation with the New York State Department of Education, and under the supervision of the district superintendent of schools, the county agricultural agent, and other members of the committee in charge of the work.

The party of the second part also agrees to repay said loan at maturity, with interest.

Signed................................
Party of the first part

....
Party of the second part

Dated..............................

I hereby consent to the above contract and agree not to claim any interest or right in the animal purchased or in the proceeds thereof that may accrue to the party of the second part. Further, I shall render such other encouragement and assistance as may tend to the proper development of the work.

Signed................................
Parent or guardian

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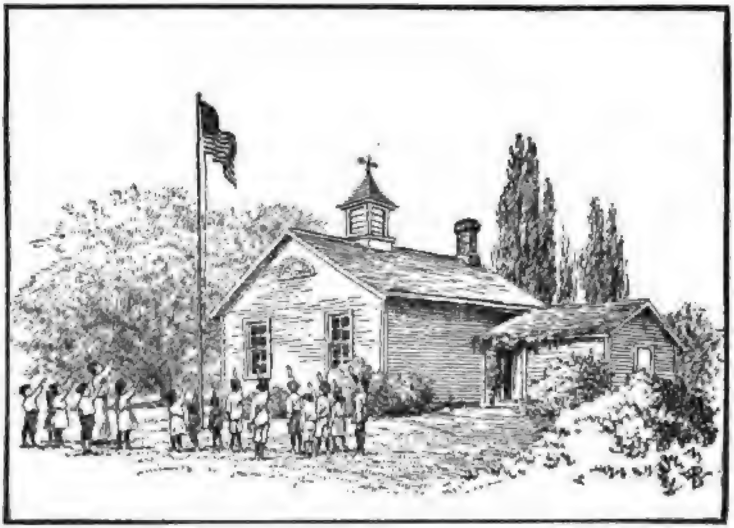
PUBLISHED BY THE DEPARTMENT OF RURAL EDUCATION, NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

VOLUME XI ITHACA, NEW YORK, MARCH, 1918 NUMBER 3



I pledge allegiance to my flag and to the Republic for which it stands, one nation, indivisible, with liberty and justice for all

THIS ISSUE IS FOR BOYS AND GIRLS

'Entered at the post office at Ithaca, New York, as second-class mail matter'

Cornell Rural School Leaflet

PUBLISHED BY THE DEPARTMENT OF RURAL EDUCATION OF THE NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY, ITHACA, NEW YORK

BLUE JAY

SUPPLEMENT TO

CORNELL RURAL SCHOOL LEAFLET

VOLUME XI ITHACA, NEW YORK, MARCH, 1918 NUMBER 3

GREETING

ALBERT R. MANN

Dean of the New York State College of Agriculture

What boy or girl is there whose heart does not burn within him as he reads in his history of the wars of his country and the great battles that have been fought on sea and land. We are living to-day in the midst of the greatest war the world has ever known — so great that all earlier wars, bitter and vast as they were, seem very small in comparison. Some day, boys and girls yet to be born will read in the histories of these great and stirring times, and will wish that they might have lived in these days and helped to win the victory that must and shall be ours. We who are now living must do our part in such a way that those boys and girls of the future will read with deep and loyal pride of the way in which all of the people of the present time, soldiers and sailors and airmen, farmers and factorymen, mothers and fathers, boys and girls and all, gave all they had and paid the full price of hardship and struggle and sacrifice and of life itself that the principles of right and honor and justice should not be halted and thrown backward in their progress.

I think of many ways in which the children of to-day can do their part. They must not be wasteful of anything — of time, food, clothing, fuel, or anything they or their families possess. We must save things, the things we now need and possess, in order to win the war; for we must not take the labor to manufacture unnecessary things to replace them. Children are sometimes wasteful, particularly of food they do not just like. If they are to do their part, they must not waste any of it. Saving waste is one of the most important ways of increasing the food supply. The other way is to produce more food. And here the country boys and girls can do their chief part. Their help is needed on the farm, because hired men are scarce and the crops must be grown. These boys and girls may be the best sort of help for their fathers and mothers. I know that they will do their best. They are too young to go to " the front," but they are just the right age to back the soldiers at " the front " by helping them to have the food and clothing they need.

The boys and girls in school have another big patriotic service. This war is taking the trained men of the country to the trenches, and many of them will not come back. When the war is over, their places will have to be filled by the boys and girls now in the schools. The positions will be large and responsible, and only those who are trained to think and

who *know* will be able to fill their places. The best service that many boys and girls can now render their country is to study hard and thoroughly, to get the best possible education in order that when the call comes, as it surely will come, for trained leaders and dependable workers, they will be ready. Good school work to-day is good war service, and it is the best sort of patriotism. Our schools must be filled with such loyal, thoroughgoing patriots.

Our American boys and girls are born to just such tasks and responsibilities as these, and we must so act that when the history of these days is read by the children of the future they will think with pride and perhaps just a little envy about the children of the present who lived in these days of splendid service and did their part well.

A LETTER TO BOYS AND GIRLS

College of Agriculture
Ithaca, New York

Dear Boys and Girls:

These are wonderful days in which to live. We are helping to make great history, and, as Dean Mann has said to you, we are anxious that it will be history of which all who come after us may be glad and proud.

Something is calling to every one, boy and girl, man and woman, in this wide land of ours. It is the spirit of service calling on us to be our best selves — fine and strong and true, patient and tolerant and cheerful, just and kind and unselfish. There is much to do, but the mistake some persons make is to look for something big and spectacular while they neglect the thing close at hand. Most of the things that need to be done are the simple, everyday tasks, and they need to be done better than ever before.

I like to think of you boys and girls who read the leaflet as a great army —" the army of the future defense," Dr. Finley has called you. You are scattered all over the hills and valleys of the State, on farms and in towns and villages. Unlike that other army of men — your brothers — you never come together and pass in review before your leaders. But if you are going to be of real service in this crisis you must come together in spirit. Through all you boys and girls there must throb the same ideals, the same desires, the same impulses.

Let us suppose that you are standing together to-day — a great army — and that you can speak as with one voice. I believe that you would say something like this:

" Each day we take the pledge of allegiance to our flag. It means more than mere words to us. It is a call to service. We want to help. We

want to be of service to our country and to the whole world. We shall begin at home — with ourselves. Some of the things we can do are these:

"1. We can keep our bodies clean and strong, outside and inside. We shall be proud to do this now. Sometimes in the past we have been careless even when our fathers and our mothers and our teachers have tried to have us careful. We shall give more attention to bathing, and

SONS AND DAUGHTERS OF "OLD GLORY"

Pupils of a three-room graded school, District 6, Town of Shandaken, Ulster County, assembled to salute the flag and sing patriotic songs after a military parade on Arbor Day

brushing our teeth, to drinking plenty of fresh water, to breathing pure air day and night, to eating right things, to forming regular habits, to taking plenty of wholesome exercise.

"2. We can be busy at helpful tasks. There have been times, we recall, when we have been asked to do things and have done them unwillingly or not at all. Now we shall do all our regular chores, such as filling the wood box, bringing water, gathering the eggs, drying the dishes, making the beds, tending the baby, without waiting to be reminded, and we shall look around on our own account for other things to do.

"3. The other things that we can do belong to three groups:

"First, there are the things that we can PRODUCE: vegetables in our gardens; corn or potatoes or beans in our fields; eggs and meat with our flocks of chickens; meat from our pigs or calves or lambs; garments with our needles; canned goods for winter; any work that has value.

"Second, there are the things that we can SAVE: food, by leaving a clean plate at every meal; meat, wheat, sugar, and fat needed for the soldiers, by eating other things instead; garments, by taking better care of our clothes; materials of all kinds, by trying not to ruin or damage articles that we have and by collecting and storing such things as paper, bottles, old iron, tin cans, tin foil, and the like, until they are needed; money, by controlling our appetite for candy and gum and moving pictures and such things, and buying Thrift Stamps.

"Third, there are the things that we can GIVE: some of the time that we now waste foolishly; work, to help older persons who have much extra to do these days, and on articles for the Red Cross; money, to the Red Cross, the Y. M. C. A., or wherever it is badly needed.

"We shall honor and believe in our school more than ever. Some new things are taking place in school these days that we like, such as helping to take the farm census; working for the Junior Red Cross; taking orders for War Savings Stamps and Liberty Bonds; organizing junior home projects in growing crops and animals, in sewing, in cooking; holding community meetings and entertainments at the school; learning more about the real world, of open fields and growing things, of men and the things they struggle for; coming to understand better the ideals of America and to honor right forever above might. In the midst of all these new activities our school still teaches us to read, and write, and do arithmetic, and spell, and draw, and sing, and play. We know that when we grow to be men and women, we shall need all these if we are to be of real service in the world.

"All these activities should make us cheerful and happy. Then those around us will be happy, too. We shall not sulk, nor grumble, nor make a fuss over things that do not quite suit us. We shall not think of life as a hardship; we shall think of it as a joy. We shall be glad to be alive every minute."

This is the way you speak — you army of boys and girls — one and all of you. We have our great chance now to show the stuff of which we are made, to prove to the world that we are not selfishly bound up in our own little lives, grabbing all we can from the other fellow, but rather that we know the real way of life to be along the road where the signboards read Health, Work, Thrift, Service. There are other signboards along this road, that tell of things we may rightly have: play, friends, books, music, pictures, stars, winds, rains, flowers, birds, and so on and on. Oh, a happy road it is when we have passed the first four signs and learned their message.

In this leaflet you will find many suggestions of things to do. No one of you will follow all of them, but all of you will follow at least one of

them. Choose those that fit you best and when you have once taken hold, stay by until you finish. I have known boys and girls and older persons too, whose most frequent expressions were "I can't" and "I don't want to." Not a very happy way to be, is it? You and I can resolve that whenever we are tempted to use those words we shall say instead "I'll try" and "I'll be glad to."

We have all had to make some sacrifices this year, you know, and one of the sacrifices you have had to make is to receive only one leaflet instead of three. It is good that you can have this one number. Take care of it. Read it often. It contains many suggestions. Some of them you can carry out now, some later on.

Write to me. In spite of the fact that the November and January leaflets could not be published this year, I have had many letters. When you have read this leaflet I shall expect to hear from every one of you, telling me of your spring and summer plans. Always be careful to put your district number, township, county, and post office address on every letter.

Let's do our part in the spirit of service.

Your friend,

Edward M. Tuttle

GARDENING

THE EDITOR

As wonderful things are hidden away
  In the breast of a little brown seed,
As ever were found in the fairy net
  Of which children sometimes read.

SELECTED

Have you found them? Will you find them? The story is never old. We can make a garden year after year all our life long and still learn something new and wonderful each year.

There is an old saying that "More grows in the garden than the gardener has sown." I wonder what that means. Do you suppose it means the weeds, for of course no gardener sows the weed seeds, yet they always seem to be there? Or do you think that there is a deeper meaning in this old saying? I have known joy to grow in a garden, and health, and —— but suppose you discover them for yourself this year.

Have a garden. It should be a vegetable garden in this year of need. Of course you may have a little corner for flowers with their bright colors and sweet odors. But mostly spend your time in growing things to eat. Grow them well so that they will look right and taste right. Grow all you can, but do not try to do so much that none of it is well done.

Search for the wonder things that come from the tiny seed. Try to discover all the things that grow in your garden and in your life when you are in your garden. Write to me about them. Tell me how much food you have produced for your family and for others. I shall be glad. Tell

WAR GARDEN VOLUNTEERS
The girl school gardeners of District 11, Town of Milton, Saratoga County

me how you have grown strong and well and sun-browned and happy. I shall be doubly glad. Several good letters about gardens follow.

District 11, Town of Milton, Saratoga County
Ballston Spa, New York, January 16, 1918

My dear Mr. Tuttle:

Last spring after we had decided to make school gardens, we had quite a difficult time in finding land for them. But at last a mill owner, Mr. Sparks, gave us a plot of land situated near our schoolhouse.

After some time we found a man to plow it but the weather was against him, so it was nearly two weeks before it was plowed and harrowed. This work was so poorly done that many of the sods were not turned

under. So we girls pulled them up, shook them out, and threw them near by.

When the ground was even we divided it into sections of two square rods each. We then selected our seeds to plant. I selected radishes, lettuce, turnips, beets, carrots, beans, corn, cabbage, potatoes, onions, parsnips, tomatoes, cucumbers, squash, pumpkins, and peas. Some of these I used in my garden at home, and some at school.

Before I began to plant I brought fertilizer from home and spread it on my land. I then raked it so as to mix it with the soil. Next I took a string and marked straight rows. I then planted the seeds.

Before school closed in June my seeds were up and I had done my first cultivating. I had done this Saturdays. During my vacation I spent my spare minutes in my gardens weeding, thinning, destroying pests, and hoeing. The radishes and lettuce matured first. They supplied our table with such nice vegetables that I felt fully repaid for my work.

In August I selected the best specimens of later vegetables for exhibit at the county fair. I was awarded three dollars for my exhibit. What was left of them I put in the cellar for winter use.

I enjoyed every bit of the work and although I am to leave the rural school for high school this month I wish to make a better garden next year with my companions.

Your friend,
ISABELLE LILLIAN WILLIAMS

Who says that girls cannot be good gardeners? Isabelle and her companions have proved that they can. So have hundreds of girls all over the State. It was a fine piece of work that was carried through at District 11 last year. Of course the same conditions will not be found everywhere, but some arrangement can always be made if you really want to grow things. Gardens at home are most common and best in many ways, especially if there is some older persons who will visit you now and then to encourage and advise. But where a number of you live close together it is interesting to take a piece of land and work it as a group just as these girls did. The only danger in this is that you may be tempted to neglect it sometimes, but I believe that you will have the stick-to-it-iveness to make it a success. Whether at home or at school try to have the best garden this year that you have ever had.

All this is just as true for boys as for girls, isn't it boys? Read the next letter.

District 6, Town of Hillsdale, Columbia County
Green River, New York, February 28, 1917

Dear Mr. Tuttle:

I am now sending one of the three letters that you wished to receive from all of the pupils.

Last summer I had a large garden and raised sweet corn, peas, pumpkins, carrots, parsnips, lettuce, radishes, string beans, cucumbers, spinach, onions, and squashes.

I cultivated them twice a week with a horse cultivator, and every day with a hoe.

I raised about seven bushels of corn, two bushels of peas, three hundred pounds of pumpkins, four bushels of carrots, two and one-half bushels of parsnips, six bushels of onions, two hundred and fifty pounds of squashes, and we were supplied with plenty of lettuce, radishes, string beans, and spinach all through the summer and fall.

I also helped in the haying. We had between twenty-five and thirty tons of hay.

I am thirteen years old and weigh one hundred and ten pounds. I am in the seventh grade.

Yours sincerely,

ROY V. HERRON

P. S. I experimented with Bermuda onions and raised one-half peck of good, medium-sized ones.

Green River district is fourteen hundred feet above sea level.

Read the instructions that Professor Schneck has given you. He has had to use some big words. Talk them over with your teacher, your father, your mother, or an older brother or sister, and try to do everything right in your garden from start to finish. Let your garden teach you all it can.

Send to the Office of Publication, New York State College of Agriculture, Ithaca, New York, for a copy of Cornell Extension Bulletin 14, *The Home Vegetable Garden*. It will help you with your garden making.

A LE ROY, NEW YORK, HOME GARDENER

THE VEGETABLE GARDEN

H. W. SCHNECK
Assistant Professor of Vegetable Gardening

IT IS not possible in this leaflet to give detailed directions on all the garden operations. If you desire to be good gardeners you will read and study garden literature, and discuss plans with those in your neighborhood who have success in growing vegetables. It is only by study that we learn to do better, and it is only by doing better and better from day to day that we find the most joy in gardening. A record of the time and expense of growing the vegetables should always be kept, with notes on the yield and value of the products. The following paragraphs will emphasize some of the most important things to consider in vegetable gardening.

Try to secure as good land as possible for your garden, but do not become discouraged if the only soil available is not especially suited to growing vegetables. Rather poor results may be obtained the first year with such soil, but by proper treatment it may be greatly improved in a short time. Soils in back yards especially are often too heavy or clayey. When wet, such soils are sticky and difficult to handle; when dry, they become very hard and compact. Heavy soils cannot be planted in early spring because they dry out very slowly. They may be improved, however, and made more workable by spading during the fall, by adding coal ashes during the winter and lime in the form of ground limestone at the rate of ten pounds per one hundred square feet each year, and by spading in stable manure. Manure improves the texture of the soil and also adds plant-food. If the manure is fresh, it should be spaded under in the fall; if well rotted, it may best be applied in the spring.

Only a very few tools are required for a garden: a spade or a spading fork, a hoe, a rake, a trowel, and a line for laying out the rows.

Size is one of the first things to consider in planning a garden. Great care should be taken not to select too large a plot especially for the first year of gardening. It is better to have a small, well-cared-for plot than a large neglected one. Much more pleasure will be derived and more and better vegetables will be grown if the garden is of such size that it

can be easily cared for. Plan just enough to keep you busy if you do it well.

After the site has been selected, a plan of the garden should be made on paper long before planting time. A list of the different vegetables to be grown should be made first; then a place should be provided on the plan for each vegetable. The number of rows of each vegetable and the distance between the rows should also be indicated.

In addition to the plan, a planting table should be made which will indicate the probable date of sowing or transplanting, the distance apart of rows and of seeds or plants in the rows, the amount of seed needed for fifty or one hundred feet of row, and the varieties to be grown. If such a table is prepared and used when planting the garden, it will save a great deal of time during the busy season, since all the directions for growing each vegetable will be condensed on a single sheet of paper. The seeds should be sown in straight rows, and the planting should start at one side of the garden and work gradually across.

Seed may be tested for viability before planting by sowing a given number, for example fifty or one hundred, of each kind in a small box of soil in the house. As the seedlings develop the strong ones and the weak ones should be counted from day to day. If only a few strong seedlings develop, the seed should not be planted in the garden; but if over one-half of the seed sown produces good, strong plants, it may be used in the garden, the thickness being regulated by the result of the test. Most children plant vegetable seeds too thickly in their gardens. This practice is very wasteful of seed and requires a great deal of unnecessary labor in thinning later on. Some children neglect to thin after the seed has been sown too thickly, and the vegetables never grow well nor produce good plants if crowded. Directions for sowing and thinning the various kinds of vegetables should be followed closely.

Many people do not know just when in early spring it is safe to sow seeds of different vegetables. Some kinds of seeds, such as spinach and peas, will grow if planted very early when the ground is still cold and wet. Under the same conditions beans or sweet corn would rot. Seed of the following hardy vegetables may be sown or plants transplanted to the garden as soon as the ground is dry enough to rake in early spring: beet, cabbage, carrot, lettuce, onion (seed or sets), parsley, parsnip, pea, radish, salsify, spinach, swiss chard, and turnip.

Seeds of the following half-hardy vegetables may be sown or plants if started in the house may be transplanted in the garden when the soil is fairly warm and before all danger of light frost is past: cauliflower, celery, and potatoes. The tender vegetables, such as bean, cucumber, eggplant, pepper, squash, sweet corn, and tomato, should not be planted in the 'en until the weather is warm and all danger of frost is past.

In order to grow into plants, seeds must have moisture and air in the soil and proper temperature after sowing. After the seeds are sown and covered, the soil over them should be pressed down so that they can obtain moisture from the soil. This is especially important with sandy soils and during dry weather. If the ground is low and wet after rains, air cannot get into the soil to the seed and it dies. On such a location the soil should be raised in the form of beds, so as to prevent the water from flooding the garden and drowning the seeds.

Many children think that after the seed has been planted all the garden work is over, but as soon as the little seedlings push through the surface, the soil between the rows should be stirred with a rake or a hoe after every rain so as to keep the surface soil loose and dry. This will cause the moisture to be held in the soil and will prevent weeds from growing.

A LITTLE ITALIAN GARDENER, WESTFIELD, NEW YORK

The chief aim in planting a home garden is to produce an abundance of vegetables of high quality in wide variety and as evenly distributed as possible throughout the season. High quality is obtained by selecting good varieties, by continuous cultivation throughout the summer, and by harvesting the vegetables when they are mature and just before they are to be used. A continuous supply of any vegetable may be provided in one of two ways: either by making successive plantings of one good early variety every ten days or two weeks, or by planting early, midseason, and late varieties at the same time. Usually the first method is the better one to follow.

During the summer the vegetables will be attacked and damaged by many insects and diseases if these enemies are not fought with great thoroughness. The two kinds of insects that give trouble are chewing insects, which eat the foliage of the plants, and sucking insects, which pierce the leaves and suck the juices from them. The chewing insects can be killed very easily by spraying the leaves with a poison, such as

arsenate of lead or paris green; the sucking insects can be controlled by spraying with some solution such as whale oil soap or tobacco extract applied so as to strike the insects. Fungous diseases may be controlled by the use of bordeaux mixture, which may be bought in paste form and is ready to use when mixed with water. It is very important to spray before the disease does much if any damage and to repeat the spraying every ten days or two weeks.

The points that should never be forgotten in vegetable gardening are:

1. Select the right-sized plot to fit your ability.
2. Make a plan and a planting table.
3. Order your seeds early and test them.
4. Prepare the soil carefully so that the seedbed will be in good shape.
5. Sow the seeds at the right time. Study the season for this. Guard against sowing too thickly.
6. Cultivate your garden faithfully and thoroughly. Be proud of it.
7. Watch for and control diseases and injurious insects.
8. Harvest your crops at the right time, use them, market them, can them, or store them, as the case may be.
9. Keep a careful record of your garden. It will help in making plans again next year.
10. Try to improve your methods constantly.

THE VOLUNTEER WAR GARDEN ARMY

THE WHITE HOUSE
WASHINGTON

25 February, 1918

My dear Mr. Secretary:

I sincerely hope that you may be successful through the Bureau of Education in arousing the interest of teachers and children in the schools of the United States in the cultivation of home gardens. Every boy and girl who really sees what the home garden may mean will, I am sure, enter into the purpose with high spirits, because I am sure they would all like to feel that they are in fact fighting in France by joining the home garden army. They know that America has undertaken to send meat and flour and wheat and other foods for the support of the soldiers who are doing the fighting, for the men and women who are making the munitions, and for the boys and girls of Western Europe, and that we must also feed ourselves while we are carrying on this war. The movement to establish gardens, therefore, and to have the children work in them is just as real and patriotic an effort as the building of ships or the firing of cannon. I hope that this spring every school will have a regiment in the Volunteer War Garden Army.

Cordially and sincerely yours,
WOODROW WILSON

Hon. Franklin K. Lane
Secretary of the Interior

JUNIOR HOME PROJECTS

F. L. GRIFFIN

Professor of Rural Education in charge of Junior Home Projects

THE three things that every boy and girl can do this year that will be of immediate and important service to the State and the nation are PRODUCE, SAVE, and GIVE. You will find other articles in this leaflet telling how you may produce, save, and give in many different ways. It is my purpose to tell how the junior home projects will enable you to produce those things that are most needed in the way of food and clothing.

VEGETABLE GARDENING PROJECT

The vegetable garden project will enable most boys and girls to produce more wheat-saving and meat-saving food, with less land, than they can do in any other way. Read the article on page 381, and begin making plans at once, provided you have not already made a start, for the best garden that has ever been raised by any member of your family.

FOODS PROJECT

The foods project work will at once qualify you for active membership in Uncle Sam's great Food Army. Class A work deals with the making of wheat-saving breads; Class B work teaches how to make the wheat-, meat-, and fat-saving dishes and meals that will be just as nourishing and palatable as those to which you have been accustomed. Class C work encourages the drying and canning of vegetables, fruits, and meats at a time when they are the most abundant and reasonable in price, for use the next winter and spring. We shall undoubtedly be called on next winter to give even more generously to our soldiers and allies of such foodstuffs as wheat, meat, and fats. We shall be able to spare these provided we have the substitutes available.

PIG PROJECT

Raise a pig if you have the proper facilities at your command. In villages and cities, as well as on many farms, enough garbage and vegetation is wasted each year to raise and fatten many pigs. Your spare time

plus the kitchen wastes from the homes in the neighborhood if you live in a village, or plenty of good pasturage and some dairy by-products if you live in the country, will transform a fifteen-pound pig into a two-hundred-pound hog in six to seven months. Boys and girls wishing to undertake the pig project but unable to obtain the desired animals at home will be aided by the promissory note plan described on page 395. Simply indicate on your enrollment card that you desire cash assistance and it will be forthcoming.

The essentials of pig raising in town or country are: a clean place for the pig to sleep, well protected from the weather; a shady, moist place in which to wallow during the hot weather; clean water constantly accessible; kitchen waste collected daily and free from broken glass, orange and lemon peelings, pork trimmings or other objectionable things; weeds from the garden, lawn clippings, or alfalfa or clover, cut and fed daily. The following story and record is from a pig project worker in the town of Spencer, Tioga County:

THE BEGINNING OF A PIG PROJECT, TIOGA COUNTY

In the spring of 1917, I saw that my country was in need of meats. Then came my opportunity to obtain a pig. I brought him home from the schoolhouse in a sack and forthwith named him Billy Pork. He was a Chester White. I wanted that breed, because they do not all go to fat, nor all to meat, but have an abundance of each.

I cut green grass and clover for him which helped to make him grow, but I attribute his early and healthy growth to some good "Red Dog Midds" with milk, and the advice of Mr. Harmon, the teacher of agriculture in the school.

My pig did not drink much water, although some. He was given feed mixed in water and milk (about three parts of water and milk to one of feed) three times a day (8 a. m., 12.30 p. m., and 4.30 p. m.). After I had given him the Red Dog Midds for a time, I changed to Schumacher and then to Pioneer Hog Feed with cornmeal and whole corn.

When Billy was small, I would get in the pen and he would put his front knees on my lap; then I would scratch his back. Later I would

get in and rub his back and tell him the events of the day. He got to be a great pet, coming when I called him. You could not get him to harm me in any way. A well-bred pig is much better than a scrub because it will bring in more money, make better meat, and stand a good chance to win a prize.

Next year I intend to have five or six pigs in connection with this work. Not only does the country need the meat, but I need the exercise and it is enjoyable. There are a great many different opinions on how to raise pigs, but I follow the advice of Mr. Harmon, the agricultural instructor.

A boy that wants to serve his country, and will stick to the business of looking after his pig and not one that lets the parent look after it, makes a good pig club member.

CONRAD FISHER

Financial Statement and Summary of Pig Project Work

Expenses

Value of pig at beginning	$5.00
Value of green feed	2.50
Value of grain feed	15.65
Value of kitchen wastes	4.32
Value of labor, 30 hours at 10 cents an hour*	3.00
Total expense	$30.47

Receipts

Final value of meat hog, 260 pounds at 18 cents a pound	$46.80

Summary

Weight at beginning	13 pounds
Weight at end of contest	260 pounds
Net gain in weight	247 pounds
Number of days fed	180
Average daily gain in weight	1.4 pounds
Cost per pound of gain	10 cents
Final net profit (approximate)	$16.33

CLOTHING PROJECT

Most girls like to sew. It is the purpose of the clothing project to teach the fundamental principles of sewing and the more important facts regarding textiles and their utilization in garment making, to the end that every clothing project worker will know how to clothe herself both becomingly and economically. Now that the war is leaving so many boys and girls destitute in Belgium, France, and Italy, perhaps no better nor more worthy purpose can be found for the clothing project than the making of garments or kits of clothing for the unfortunate children living across the Atlantic.

*As regards the labor item, Conrad wrote as follows: "The benefits that have come to me from looking after the pig are worth the labor and more, so I claim the $3.00 labor charge should be taken off the total cost."

The project has been so modified that a girl can make either garments for herself or clothing kits or articles for kits to send to France and Italy.

The following letter from a last year's clothing project worker tells how one girl enjoyed the work:

District 8, Town of Barre, Orleans County
Albion, New York, January 9, 1917

Dear Mr. Tuttle:

I am taking the project work in sewing and have the first article nearly finished, which is a combination apron.

I think the project work is very interesting. I also have a notebook started. I am now writing about flax and cotton, where they come from and the process of the making of cloth from them, from the time they are taken from the field until they are sent to all parts of the world after being made into a great many things. There are so many things made from these two plants that we could hardly think of all the things if we were to try.

The project work also has many other things which are very nice to do and it helps you when you are older to do these things that you learn when you are young and if you once get them learned well, you will never forget them.

One of your leaflet readers.

NETTIE A. GOODWIN

COW-TESTING PROJECT

The cow-testing project can be made of very great service in any dairy section where there are no cow-testing associations. There is good reason to believe that tens of thousands of the cows now being fed and milked on New York farms are not paying for their feed and care. The only way these "boarders" can be detected, is to keep a record of the weight of the milk each produces, the percentage of fat contained in the milk, and the amount and value of the feed each consumes.

NETTIE'S FRIEND BEATRICE AND THE RESULTS OF THEIR CLOTHING PROJECTS
District 8, Town of Barre, Orleans County

Since the older boys and girls can learn how to make the Babcock test, can weigh the milk and take samples for testing, and can keep a record of the feed consumed, the keeping of the milk, fat, and feed records of

the cows in your father's herd, or of those belonging to some neighbor who does not have any boys or girls old enough to do such work, will be patriotic service.

CALF-RAISING PROJECT

The calf-raising project is also especially good for boys and girls who live in dairy sections or on farms where one or more cows are kept. Good grade cows from heavy-producing strains, as well as purebred cows, will always be much in demand. Boys and girls who start now with a good heifer or a purebred bull calf will find that they have undertaken a project that will grow rapidly into money. The following letter from a boy who raised a calf is interesting and indicates what a boy or a girl can do:

A CALF-RAISING PROJECT UNDERWAY, CHEMUNG COUNTY

District 2, Town of Arcade,
Wyoming County
Arcade, New York, April 9, 1917

Dear Mr. Tuttle:

I am writing to tell you about my calf. I bought her of my uncle for one dollar. I sold her when she was six months old for twenty dollars. I am stating below how much it cost for feed and how much I gained. She was black and white; she was about two-thirds white.

Cost of calf		$1.00
First month:		
Whole milk	$1.47	
Skimmed milk	.56	
Second month:		
Skimmed milk	1.10	
Grain and whole milk	.80	
Third and fourth months:		
Skimmed milk	2.16	
Grain	1.50	
Fifth and sixth months:		
Skimmed milk	2.16	
Grain and hay	2.25	
Cost of feed	$12.00	

Cost of feed	$12.00
Cost of calf	1.00
	$13.00
Sold her for	$20.00
Cost	13.00
Gain	$7.00

Don't you think I did pretty well for the first time? I will write and tell you about my calf a little later. Your friend,

W. W. HOLMES

A JUNIOR SHEEP RAISER, STEUBEN COUNTY

Any boy or girl desiring to undertake the calf project who cannot obtain the desired animal at home or who does not have the funds available for its purchase may take advantage of the promissory note plan described at the end of this article.

SHEEP PROJECT

It is doubtful whether the demands for mutton and wool will be met for many years to come. In any event, it is certain that sheep will prove to be very profitable on many New York State farms. Any boy or girl who can provide the facilities necessary for raising sheep (a properly fenced pasture, comfortable quarters for winter, plenty of good hay and some succulent feed, such as beets or other root crops) will learn the real significance of the term "Golden Hoof," which is applied to sheep.

Boys and girls desiring to undertake this project but unable to procure the animals or the funds for their purchase need only to make their wants known, and the funds or the animals will be supplied by means of the promissory note plan.

CROP PROJECTS

Some boys and girls may be more interested in raising potatoes, corn, or beans than in some other project. Each of these projects has been planned in three different divisions according to the age of the worker. This enables the boy or the girl to undertake just what he or she can do best.

THE PROMISSORY NOTE PLAN

Any boy or any girl who desires to undertake the pig, the calf, or the sheep project but is unable to obtain the desired animal, may procure the funds for its purchase by means of the promissory note plan. This means simply that a boy or a girl can gc to a certain bank in the locality and, by signing a note promising to pay a certain sum on or before a given date, obtain the money with which to buy the desired animal. This money, as a rule, will be paid to the person selling the animal and not directly to the applicant for the loan. This note will usually bear interest at five or six per cent. The applicant for such a loan should also sign a contract binding himself to take the best possible care of the animal purchased with the funds thus obtained, to become a junior home project worker, and to live up to all the obligations of the project. When the funds are for the purchase of a pig or one or more sheep, the note will probably not have to be endorsed (signed by the parent or some other responsible adult). When the funds are for the purchase of a purebred calf and are more than fifty dollars, the note should be endorsed by the parent.

In order to protect the project workers whose animals may die before the work is completed, it is suggested that each one taking advantage of the promissory note plan have ten per cent of the value of the animal added to the amount of the note, for the creation of an insurance fund. If there is any loss, it can be divided among all the members. Should there be no loss the amount of the insurance assessment will be deducted from the amount of the note. This cooperative insurance is safe for all practical purposes.

There is at least one banker in nearly every city and village in this State who will be glad to help a boy or a girl to start a calf, a pig, or a sheep project by the promissory note plan. If any difficulty is encountered in getting such help, or if more information is desired concerning any phase of the project work, ask your teacher or your district superintendent, or write to the Department of Rural Education, New York State College of Agriculture, Ithaca, New York.

The November 1917 Cornell Rural School Leaflet, a special number for teachers and supervisors, contains full particulars regarding junior home projects. Your teacher should have a copy of this leaflet. If she does not, one may be obtained by writing to the Department of Rural Education at the College.

All the best in life's the simplest,
Love will last when wealth is gone;
Just be glad that you are living,
And keep cheering some one on.

SELECTED

POULTRY RAISING

KEEN delight is taken by boys and girls in the care of living things. A flock of poultry reared from the baby chicks is a source of pleasure and education and in these days a source of needed food. At the school you can all discuss poultry raising: the best breeds and varieties to choose, the selection of eggs for hatching, hatching and rearing the chicks, winter quarters, methods of feeding, and the like. Refer to the September 1915 teachers' leaflet; there should be one in the school library. If not, ask your teacher to send to the Editor for a copy.

Some schools have raised a flock of chickens at the schoolhouse, but usually the best plan is for each boy or girl who can to have a flock at home. Rather frequent reports at school on the progress of the flocks are of value, as are visits to each other's poultry yards to discuss different methods.

The letter that follows shows how an older boy has taken hold of the poultry question. Both boys and girls much younger are doing good work. Note what this boy says about education. We should keep learning and growing in knowledge as long as we live.

District 10, Town of Knox, Albany County
Delanson, New York, April 7, 1917

Dear Mr. Tuttle:

We received the January leaflet and enjoyed reading it very much.

I have been thinking that perhaps you would like to know how many hens I have got this year. I have forty-two Rhode Island Reds. Thirty-six of them are last year's pullets. I raised seventy chickens last year, also helped on the farm and helped take care of father's chickens. Thirty-two of my layers are in one pen and ten breeders are in my colony house. The breeders layed one hundred and ten eggs in January, one hundred and thirty-two eggs in February and two hundred and nineteen eggs in March, an average of nearly twenty-two eggs for each hen in March. Nine of the ten breeders were pullets. I have five little chickens over a week old.

A TIOGA COUNTY GIRL AND HER FLOCK

I am sixteen years old and about ready to give up my school education

although I think I would like to try a winter course in agriculture in some agriculture school.

Sincerely yours,

ELVIN J. COLLITON

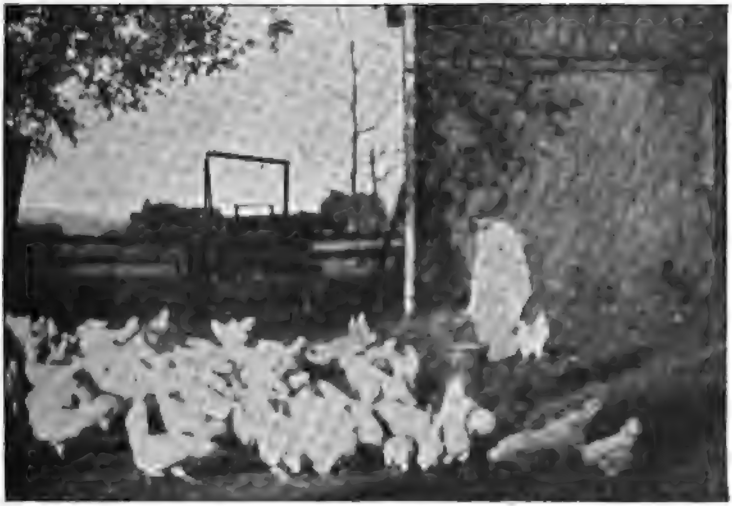
It is stimulating to learn from Mr. Krum in the following message that poultry raising is another opportunity for service.

ONE WAY OF DOING YOUR BIT

W. G. KRUM

Extension Instructor in Poultry Husbandry

Nearly all the boys and girls on the farms or in the villages can show their patriotism and help to increase the food supply by growing a flock of chickens during the coming season.



THIS TIOGA COUNTY BOY KEEPS BUSY AND HAPPY

Be sure that you start with gooa stock, or you will only be wasting good feed.

Scraps from the table and skimmilk from the dairy will take the place of part of the expensive poultry feeds and help to grow the young roosters to broilers or roasters for market or for the home table.

Protect the growing pullets from cats, rats, and hawks. Feed them well all summer, and house them comfortably during winter so that they will furnish you with fresh eggs when eggs are scarce and prices are high.

The essential things to keep in mind are that poultry should have plenty of fresh air, sunlight, clean water, oyster shell, grit, charcoal, and a variety of good food fed regularly, and that the chickens should be housed in clean, light, warm, dry, well-ventilated houses.

CARE OF FARM MACHINERY

TWO SUGGESTIONS

W. K. Blodgett

Assistant Extension Professor of Rural Engineering

Editor's note.— Here are real ways to serve. The two suggestions that follow bring to mind many others. Surely boys and girls on the farm can help greatly to save time and trouble and expense by taking care of the tools and the machinery, keeping them cleaned, well oiled, and in running order. Who will write next summer and tell about work of this kind?

WRENCHES AND NUTS

Ask your father for permission to put the one-horse cultivator in good condition. In the first place, use a putty knife or some scraper to clean off all the dirt. Then with a wrench tighten loose nuts and bolts. Right here make it your rule never to use a wrench on a nut unless it fits closely. If you are a little careless about this point, the loose-fitting wrench will soon round off the corners of nuts or bolts. Then they will be very difficult to hold or turn with any wrench. You may find that some nuts stick and refuse to turn on the bolts. Put a few drops of kerosene on them and leave them; they will turn more readily the next day. In putting nuts or other metal parts together apply a little oil or grease. Thus they will come apart more easily next time.

USE FOR THE OILCAN

Why could you not oil the mowing machine in the morning just before your father is ready to drive it into the field? It will save him a few minutes. Procure a stiff wire, such as a wire hairpin, and clean the dirt and the grass seed out of the oiling places. No, do not use the end of the oilcan snout for this purpose or you will soon find that the can will not feed any more oil. Do not remove the packing that you may find in one or two of the big oilcups. This packing is to hold the oil so that it will run down slowly to the bearing as needed. Although cotton is sometimes used here, it is not desirable, for it fills the feed hole too tightly; wool just as it is clipped from the sheep's back is the proper material to use. Put a few drops of oil into each hole. Are you sure that you can find all of them? Every part that runs or rubs on another part when a machine is working should receive oil. To this rule there is one exception in the case of a mowing machine: it is not considered necessary to oil the knife where it runs back and forth on the finger guards. Be sure to put your wire and the can of oil in the mower box. The driver will need to use them in an hour or two.

FOOD CONSERVATION

MARTHA VAN RENSSELAER
Professor of Home Economics

You have heard, no doubt, about food conservation, and you know that we must save because it is necessary to feed our soldiers who are fighting for us, and to feed our allies. You want very much to know just what each one of us should do to help. I am going to suggest a few things so that you may feel that you too are helping to win the great cause for which your big brothers and all the big brothers across the sea are fighting.

Eat what is placed before you, and take only as much as you need. Perhaps you are used to helping yourself to more than you can eat. After this take less, never more than you can eat. It is better to have a second helping than to waste good food. Or perhaps you do not care for some of the new things your mother is giving you to eat, and are leaving them untouched on your plate. Remember that now is the time to show that you care more to do something for your country than to please yourself. Perhaps because you are eating something you do not care for, some one across the ocean is going to have food to keep him from being hungry.

You have surely heard about meatless days and wheatless days. Perhaps you have heard your mother say she cannot get sugar at the store, and you have heard people talking about saving fats. This is because there is not enough of these things for us to have plenty for ourselves while we send to our soldiers. It is just as if some members of the family ate up everything in the pantry, and left the others to go hungry. Surely none of us want to do that. So we must be willing to eat less of these things, mustn't we? Then we may send more across the ocean.

This does not mean that you shall go hungry. It does mean that you must be willing to eat cornmeal bread very often in place of ordinary white wheat bread, and graham or whole wheat bread because they take less wheat flour; and that you must eat cornmeal mush and oatmeal instead of breakfast cereals made of wheat. It means that you must not expect meat more than once a day, and perhaps not even that often. Remember that milk is better for you than meat and that the less meat you eat the more there is for our soldiers. They need meat because it makes them strong to fight.

Of course it does not rest with you to choose your meals, but when your mother gives you less meat you will not complain because you know the real reason for it.

And about sugar, I think that you could easily eat less on your oatmeal in the morning and on your puddings and desserts. And how many, many times we all take something sweet between meals — perhaps candy,

perhaps something at the soda fountain. And do you stir the sugar in the bottom of your cup of cocoa so as to make the most of a little instead of using a lot that does not dissolve? There are many ways in which we can eat less sugar and save it for our soldiers and for the little boys and girls in France and Belgium who have very, very little.

One more thing, that is about fats. You need some fat, and you are going to be given fat. Butter is fat and is good for you, and so is the fat in milk, which you call cream. But perhaps you are used to a great many fried foods and to pies and other rich things. When your mother gives you less of these you ask why. Now you know why. It is because fats are needed for our soldiers and must not be used up in frying and in pie crusts.

If you remember these few rules — to waste nothing, to eat less sugar, less wheat, less meat, and fewer fried things than you have been accustomed to — and if you follow them, you may be sure that you are a food soldier and are helping to win the war just as much as the soldiers in khak

Editor's note.— The boys and girls who read this leaflet are old enough to understand what Miss Van Rensselaer has said about our food supply, and old enough to help very much in this need for saving. It means that we are all going to change our diet somewhat. Some of the things of which we shall be eating more are: milk, eggs, fish, poultry, potatoes and other vegetables, fruits, honey, maple sugar, and corn, rye, and oat products.

In connection with food there is something else that is important, that is, drinking plenty of water. Most of us do not drink nearly enough. Three pints a day, we are told, is none too much. That means six glasses. A good plan is to drink a glass or two on getting up in the morning, and again in the evening before going to bed. The body needs bathing inside as well as outside. Drinking plenty of water helps to keep us well and free from colds, helps the body to function properly, and keeps our skin clear and fresh. Make it a habit to drink more water; it is a good habit.

FOUR WAYS TO HELP

Knit, knit, what shall I knit?
Something warm for a soldier's kit.

Sew, sew, what shall I sew?
Something that to the Red Cross may go.

Write, write, what shall I write?
Just a line to a soldier, and send it to-night.

Eat, eat, what shall I eat?
More potatoes and less wheat.

ELEANOR WESTFALL
Number 2 school, 7th grade, Saratoga Springs

NEWS FROM FRANCE

Boys and girls in New York State will be interested to read this story of how rabbits are raised in France, and the uses to which they are put. Perhaps some one will want to try it here although we have not reached the place in this country where there is any large demand for domesticated rabbits. In individual homes, however, a few rabbits might easily be raised to reduce the amount of beef and pork consumed. Care should always be taken not to let the rabbits get loose and run wild, for they increase very rapidly and in large numbers do a great deal of harm. Madame Engel is a French lady who is now living in New York City. She feels that boys and girls in this country will be interested in knowing what the French people have done in raising rabbits and she shows very clearly in the following article how well they have worked out the plan.

RABBIT RAISING A LA FRANCAISE

MADAME RENE ENGEL

It is easier and more practical to raise what we need than to go without it. For this reason I want to tell Americans how the French increase their meat output.

Almost every family in France living in the country or small towns, raises rabbits and chickens. The rabbit is perhaps the easiest and least expensive of all animals to raise. For rabbit hutches the French use packing boxes of uniform shape and size, about three feet by two and a half. Each of these has a wire screen door on the front, with hinges on the lower edge of the box. They pile these boxes one above the other in rows, either in barns or sheds or out of doors if the climate permits. In summer the rabbits are fed on the newly cut grass from lawns or on grass gathered from roadsides. Potato and apple parings, also scraps from the table, except meat and fish, may be used. The French are very careful, however, never to give them any water. In winter a little bran may be added to turnips and carrots if there are not enough scraps from the table. The older rabbits, one to a box, are never let out except for mating; thus the muscles do not become hard from running and exercise and the rabbits keep fat and in good condition. They are fed twice a day.

Rabbit skins are very valuable at present for furs and also for making animal glue, which is the best on the market and greatly sought after in France for use in war material.

A rabbit six months old provides two meals for a family of six. It is very tender and almost like chicken when roasted with a good dressing. Cut in small pieces and rolled in meal or flour and fried, it is as good

as any fried chicken. The canning factories make use of rabbits in France. Many a *poilu* in the trenches has been glad to get a can of cooked rabbit to vary the habitual meal of corned beef, which he calls *singe* or *monkey*.

The common tan-colored rabbit is the easiest to raise, for the young are less delicate than those of the beautiful white Russian rabbit, although I have known one of the latter who has lived in his box comfortably for nearly two years.

YOUR OPPORTUNITY TO HELP

George A. Works
Professor of Rural Education

It is not easy for me to send even a short message to the young readers of the Cornell Rural School Leaflet without mentioning the war. So I am not going to try to avoid it. Some persons say that the war should not be permitted to disturb the lives of the children. Certainly I do not wish to see the war interfere with your opportunities for an education, but I do hope that it brings home to you the fact that you can help your country in this hour of need. Every one who is old enough to read these paragraphs is old enough to render some definite service. May I suggest a way in which you can help?

The soldiers who have gone to France to fight for us must have food and clothing. These our government has to buy with money that it borrows from us. Much of this money the government borrows by selling bonds, but these cost so much that there are very few boys and girls who can buy them. Just lately a new way of raising money has been devised. This is by means of Thrift Stamps, which are intended to help people to lend small sums of money to the government. If you do not know about these stamps, you should ask your teacher to explain about them. I am sure that you can buy enough stamps so that you will be able to get at least one War Savings Certificate. I know boys and girls even younger than you who are saving their pennies for this purpose. This Thrift Stamp idea is such a good one that I hope the government will continue it after the war. It certainly will do more to teach boys and girls how to save than many talks and essays on thrift.

In writing of these Thrift Stamps I may have suggested a war service that you are not in position to render. If this is true, seek some other way of helping. Surely among the many ways that are suggested in this number of the leaflet you can find something to do that will be of service to our country at this time. It will be well if in doing these things you are acquiring habits and knowledge that will be helpful to you in later life. Useful men and women learned to do useful things when they were boys and girls.

W. S. S.

Have you learned what these three letters mean? They are seen everywhere. They stand for

War Savings Stamps

War Savings Stamps are issued by the United States Government and are sold by all postmen, by most banks, and by many business concerns that have been given proper authority. There are two kinds. Thrift Stamps cost twenty-five cents each but bear no interest. They should be attached to a Thrift Card (see illustration on page 404) as fast as you buy them. When you have a card full — sixteen stamps in all, four dollars' worth — you should change it for a War Savings Certificate Stamp by paying a few cents more, depending on the month of the year (see table at bottom of Thrift Card). A War Savings Certificate (see illustration on page 405) will be given you to hold the larger stamps, each of which will be worth five dollars on January 1, 1923. The increase over what you paid for it is the interest that the Government gives for the use of your money. The War Savings Certificate has places for twenty stamps (only fourteen are shown in the illustration). Thus when it is full it will be worth one hundred dollars on January 1, 1923. In case you should need your money before January, 1923, you can get it back with interest up to the time you take it out, by giving ten days' notice.

Now how does this affect you boys and girls? It affects you in two ways: (1) you can save up and buy stamps of your own, and (2) you can help other people to understand about War Savings Stamps and encourage them to buy.

In the *Bulletin to the Schools* of December 1, 1917, sent to you from Albany by Dr. Finley, there is a very complete account of W. S. S. Read it over and over and talk about it together until you understand it thoroughly. It is not too difficult even for those in the lowest grades to know how they can begin saving and buying Thrift Stamps. A plan has been worked out whereby you older boys and girls can help in the sale of War Savings Stamps in your neighborhoods. It centers around the Colored Postcard, both sides of which are pictured on page 407. Your school can obtain some of the Colored Postcards and a set of instructions to solicitors from the chairman of your county W. S. S. committee (see list on page 408). Ask also for copies of the leaflet of "Questions and Answers" (Publication No. W. S. 113).

When you find some one who will buy a W. S. S., fill out the Colored Postcard carefully and completely and give it to the postman. You do not collect any money. The postman takes the stamps and cards to the

person who has ordered through your efforts, and he collects the money. You are simply an agent. Your best argument will be your own Thrift Card. Carry it with you.

UNITED STATES GOVERNMENT
THRIFT CARD

Take good care of your *Thrift Card*. If your *Thrift Card* is lost the money paid for stamps can not be recovered.

Thrift Stamps are on sale at post offices, banks, trust companies, and other authorized agencies.

Affix only 25-cent U. S. Government *Thrift Stamps* in spaces below. Do not use Postage Stamps.

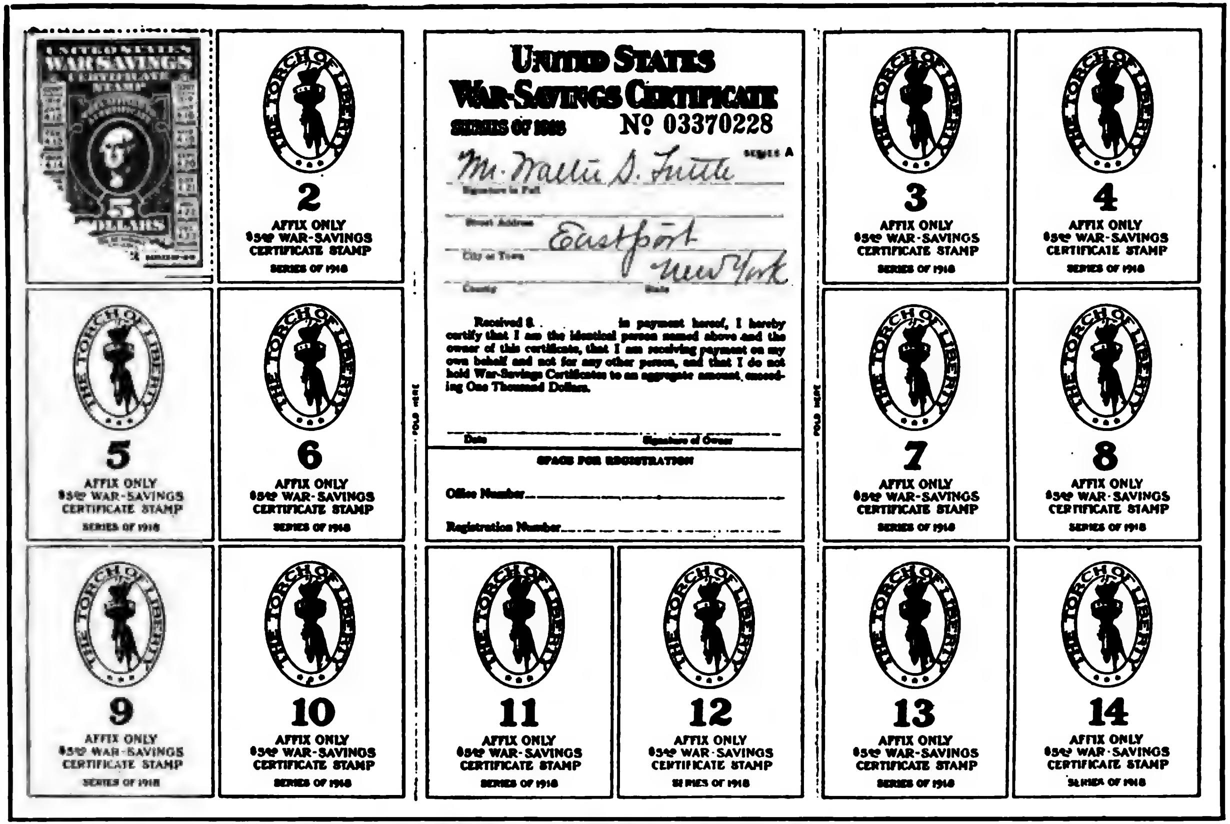
	5 The first principle of money-making is money saving.	9 Many a little makes a mickle.	13 Save and have.
2 Your second stamp here.	6 Don't put off 'till to-morrow.	10 Saving creates independence.	14 Great oaks from little acorns grow.
3 If you want to succeed, save.	7 A penny saved is a penny gained.	11 Thrift begins with little savings.	15 Waste not; want not.
4 Thrift is the power to save.	8 All fortunes have their foundations laid in thrift.	12 Money placed at interest works day and night—in wet and dry weather.	16 Learn economy and you start on the road to success.

Important.—When you have affixed the sixteen 25-cent U. S. Government *Thrift Stamps* representing $4, take this card to a post office, bank, or other authorized agent, pay the number of cents indicated below the month in which the exchange is made, and you will receive a *War Savings Certificate Stamp* for which you will be paid $5 on January 1, 1923.

MONTH	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Cents	12	13	14	15	16	17	18	19	20	21	22	23

How a Thrift Card looks with the first stamp attached, about three-fourths actual size. The corner of the stamp was blotted out to comply with a Federal Law which prohibits the publication of any kind of Government obligation. The mottoes in the spaces for the stamps are especially good, and are worth committing to memory and applying on all occasions. Start your Thrift Card at once, if you have not already done so. Fill it up and exchange it for a War Savings Stamp. (See opposite page)

We cannot all buy a Liberty Bond, but we can all buy a twenty-five-cent Thrift Stamp now, and another one next week or next month, and so on. There will be many ways that you will find to earn and save money when you really set about it. Write to Mr. Tuttle and tell about your experiences. Perhaps they will help others.



How a War Savings Certificate looks with the first stamp attached, about one-half actual size. Each stamp costs this year a few cents more than four dollars. On January 1, 1923, each stamp will be worth five dollars. There are places on the certificate for twenty stamps (six are on the other side) thus, when full, it will be worth one hundred dollars at maturity. War Savings Stamps make good presents. The Editor gave the one shown above to his brother for Christmas

The plan of War Savings Stamps was worked out by Frank A. Vanderlip, of whom you were told in the *Bulletin to the Schools*. Remember a few of the things he has said:

The whole plan is simplicity, convenience, profit and service to the highest degree. It gives to every class of Americans even those of the smallest means, the opportunity to save money and to lend it to their own Government at four per cent compound interest, with the right to have their money back, with increase, at any time. It brings to every man, woman, and child a strong inducement to economize in food, clothing, and personal indulgence, and to use his savings to increase his own fortune, to strengthen his Government and to support the gallant soldiers and sailors who are giving their lives for us. * * * * *

The challenge of this new opportunity to save and to serve for America and for humanity must be heard and heeded by all who share the blessings of this great free land and who owe allegiance to its flag. America has taken up the greatest burdens that can come to the richest, strongest nation on earth. All of us, business men, professional men, officials, and laboring men, women, boys, and girls, are, first and last, Americans, and the tasks and problems of our beloved country come straight home to us. We are its strength and its wealth. We must carry its burden and perform its tasks. We must win its victory. * * * * *

Millions of boys and girls who, with many a salute have pledged allegiance to the flag and the Republic for which it stands, are now to have the pride and pleasure of rendering that allegiance in a real service which shall help their country to win this great war. * * * * *

The call is to every American, whether he has sprung from the free soil of America or has been transplanted from other soil to flourish here. Now is the time to dedicate heart and soul and body to the great cause for which America is fighting. Lose not a moment in beginning the collection of War Savings Stamps. Add to the amount every day of the year. Nothing short of your very best now and all the time will be enough.

" Help one another," a penny said
To a fellow penny, round and red,
" Nobody cares for me alone,
Nobody'll care when I am gone;
But we'll stick together, and grow in time
To a nickle, or even a silver dime."

" Help one another," I heard the dimes
Whisper beneath the Christmas chimes;
" We're only little folks, but you know,
Little folks sometimes make a show;
Ten of us if we're good and pure,
Equal a big round dollar, sure."

From *Help One Another*

Name of Solicitor's Organization
Name of Solicitor
Address of Solicitor

PAY NO MONEY UNTIL STAMPS ARE DELIVERED

BY BUYING WAR-SAVINGS STAMPS:

(1) You help your Government by lending it your savings.
(2) You invest your savings safely at 4% compound interest.

POSTMASTER:

Kindly have letter-carrier deliver to me on ______________ (Date)
for which I agree to pay him on delivery:

.... $5 U. S. WAR-SAVINGS STAMPS at $.............. each.
(See prices on other side)
.... 25c. U. S, THRIFT STAMPS at 25c. each.

W.S.S.
WAR SAVINGS STAMPS
ISSUED BY THE
UNITED STATES
GOVERNMENT

NAME ______________________________

ADDRESS ______________________________

You should paste War-Savings Stamps on *War-Savings Certificates* and Thrift Stamps on *Thrift Cards.* Certificates and Cards are furnished without additional charge. In the space below order them as needed for each member of your family who buys stamps.

Send me—
.... WAR-SAVINGS CERTIFICATES. .... THRIFT CARDS.

[W. S. 138]

TREASURY DEPARTMENT
OFFICIAL BUSINESS

Penalty for private use to avoid payment of postage, $300

This is the size of a
U. S. WAR-SAVINGS STAMP
Each one you own represents a promise of the U. S. Government to pay you
$5.00
on January 1, 1923
when affixed to a War-Savings Certificate

COST DURING 1918

Jan. $4.12	May $4.16	Sept. $4.20
Feb. 4.13	June 4.17	Oct. 4.21
Mar. 4.14	July 4.18	Nov. 4.22
Apr. 4.15	Aug. 4.19	Dec. 4.23

The difference between these prices and $5.00 is your interest.

THIS CARD CAN BE MAILED FREE

THIS IS THE SIZE OF A
25c
U. S. Thrift Stamp
Collect these and exchange for a War-Savings Stamp.

To the local
POSTMASTER

How both sides of the Colored Postcard look, about seven-eighths actual size. This is for use by persons who solicit purchasers for Thrift and War Savings Stamps. Get a supply of these for your school from the W. S. S. county committee, and carry a couple with you always so that you will be ready to take an order. When some one agrees to buy one or more stamps of either kind, fill out the card properly with his name and address, the date, and the number of stamps and cards desired, and with your own name and address, and mail it. The letter carrier will do the rest. Every boy and girl can be a W. S. S. agent

W. S. S. COUNTY COMMITTEE CHAIRMEN

County	Name	Address
Albany	James E. Manning	Albany, 70 State Street
Allegany	Harry E. Keller	Cuba
Broome	John J. Irving	Binghamton, Phelps Building
Cattaraugus	M. G. Fitzpatrick	Olean
Cayuga	Albert H. Clark	Auburn, 144 Genesee Street
Chautauqua	Cyrus E. Jones	Jamestown
	F. W. Crandall (Vice Chairman)	Westfield
Chemung	J. Sloat Fassett	Elmira
	Wallace W. Seeley (Vice Chairman)	Elmira, State Memorial Building
	William H. Snyder (Vice Chairman)	Elmira, Snyder Block
Chenango	Albert F. Gladding	Norwich
Clinton	John F. O'Brien	Plattsburg
Columbia	Philip M. Harder	Hudson, 410½ Warren Street
Cortland	Charles Brown	Cortland
Delaware	Hector S. Marvin	Delhi
Dutchess	W. A. Adriance	Poughkeepsie
Erie	E. M. Husted	Buffalo, Dun Building
Essex	Mortimer Y. Ferris	Ticonderoga
Franklin	Le Roy M. Kellas	Malone
Fulton	Abram Baird	Gloversville
Genesee	Schuyler C. Wells	Le Roy
Greene	Herman C. Cowen	Catskill
Hamilton	Abram Baird	Gloversville
Herkimer	Seth G. Heacock	Ilion
Jefferson	Henry M. Brown	Watertown
Lewis	C. Fred Boshart	Lowville
Livingston	E. Everett Doty	Geneseo
Madison	Leonard L. Saunders	Wampsville
	J. H. Fort (Vice Chairman)	Oneida
Monroe	Harper Sibley	Rochester, 100 Sibley Building
	E. E. Morris (General Secretary)	Rochester, 106 Sibley Building
Montgomery	William B. Charles	Amsterdam
Nassau	David N. Gay	Glen Cove
	George S. Emory (Vice Chairman)	Mineola, Nassau County Trust Company
Niagara	Alex Porter	Niagara Falls
Oneida	John M. Ross	Utica, Elizabeth and Charlotte Streets
Onondaga	Alan C. Fobes	Syracuse
Ontario	Peter R. Cole	Canandaigua
Orange	L. C. Purdy	Middletown, 12 South Street
Orleans	Francis M. Blake	Albion
Oswego	John W. Stevenson	Fulton
Otsego	George H. White	Cooperstown
Putnam	Clayton Ryder	Carmel
Rensselaer	Frank E. Howe	Troy
Rockland	Benjamin J. Haas	Nyack
St. Lawrence	William M. Stephens	Ogdensburg
Saratoga	William H. Manning	Saratoga Springs
Schenectady	Allen W. Johnston	Schenectady
Schoharie	A. C. Kilmer	Cobleskill

County	Name	Address
Schuyler	Arthur J. Peck	Watkins
Seneca	Myron W. Bassette	Interlaken
Steuben	Robert C. Turnbull	Bath
Suffolk	Otis G. Pike	Riverhead
Sullivan	John T. Curtis	Monticello
Tioga	Percy L. Lang	Waverly
Tompkins	Clarence D. Tarbell	Ithaca
Ulster	John E. Kraft	Kingston
Warren	George Tait	Glens Falls
Washington	Hiram J. Stevens	Granville
Wayne	C. Warner Mills	Sodus
Westchester	Reginald P. Ray	White Plains, Westchester and Bronx Title Company
Wyoming	W. J. Humphrey	Warsaw
Yates	Calvin Russell	Penn Yan

W. S. S. NATIONAL POSTER COMPETITION

Word has just come of a poster competition that, for the Eastern States, will run to May 15, 1918. Three themes are suggested for the posters: (1) *Manufacture and Labor*, to show that all our energy should be directed toward producing the necessary war materials; (2) *Thrift*, to appeal to the spirit of economy and saving; and (3) *War Savings Societies*, to stimulate the formation of groups pledged to save and serve. The country is divided into four groups of States, and the contestants into three classes according to school grade. Six prizes and three honorable mentions will be given in each class in each group, and one national prize will be awarded to the very best poster of all in each class.

Boys and girls in and above the seventh grade may compete. There are certain rules and regulations to be followed. Write to your W. S. S. county committee chairman for full instructions.

OUR FLAG

O flag, our flag, now floating on high,
Now falling, now curling, now lifting to fly,
And waving again in your fine proud way
Over the country and into the day.

You wave o'er so many beautiful lands,
And you're honored both here and there.
Your stars and your stripes are the symbols of right
And we'll serve you with all our might.

LEAH IRENE WELLS
Number 2 school, 7th Grade, Saratoga Springs

Editor's Note.—Do you like these verses and the ones on page 400? It is worth while for boys and girls to try to put their best thoughts and impulses into words as our friends in Saratoga Springs have done. Suppose you try, too.

A MESSAGE TO LITTLE READERS

College of Agriculture
Ithaca, New York

Dear Boys and Girls:

Would you like to have me tell you another story — another true story? It happened last fall in the little town of South Otselic in Chenango County. You can all find the place on the map if you look. A school fair was held there for the schools from three townships. We had a good time all day looking at the exhibits, seeing the prizes awarded, and playing games. After it was over I went for a walk with a group of the boys and girls who lived in the village. Coming back they began to ask what we could do in the evening, for I was going to stay there all night. One suggested that we meet in the schoolhouse from seven to nine and do something nice.

"Good," I said, "we can study some geography, and English, and history, and lots of things that you have missed to-day."

"Oh, no! no!" they cried, "We don't want to study those things. We want to have you read to us; we want to sing some songs."

"All right," I answered, "We'll see when the time comes. Good-bye, till seven o'clock."

It was a strange feeling to go to school at night. As I walked up to the building I could see little figures ahead of me in the dusk. Here and there a light flashed. Soon we were all gathered in the room, twenty-one of us. On the desk was an oil lamp; another stood on the piano.

What a good time we had! We did study some, too, although perhaps it did not seem like study. For one thing we took the map of New York State and found out how to get from South Otselic to Ithaca. Wasn't that geography? They talked about their gardens and pets and home life. Wasn't that English and nature study? I read them a story and two or three poems. One was about Columbus. Wasn't that history?

Then we sang. Such fine singing it was, because every one tried hard. I do not remember all we sang, for there were a good many different songs; but I do remember *Wynken, Blynken, and Nod*, and *The Bobolink Song*, and *Old Dog Tray*. Sometime in the leaflet I am going to print *Old Dog Tray*. You will like it as they did — best of all, they said.

We sang some of the rounds. They are the most fun of anything. We sang them in four parts, five boys and girls in each group and I leading. After a time one girl suggested that each group go into a different corner of the big room and see how it would sound. Away they scattered into the shadows. I stood in the center, and round and round the songs went from one group to the next — *Row, Row, Row Your Boat*, *To the North Pole*, and the others.

Nine o'clock came too soon, but we had agreed to stop then; so we did by singing *Auld Lang Syne* as we stood in a big circle swinging hands. I shall never forget that night we went to school, and I do not think those boys and girls will, either. I am sure we learned a great deal, besides having a fine time and growing to be firm friends.

If I had a wishing cap I would wish to meet all you boys and girls who read this leaflet and have some such good time with you. But that is not possible all at once. The next best thing is to write letters. You cannot know how much I enjoy your letters. Some of the best ones are from boys and girls only seven and eight years old. It would make me happy to receive three letters from you between now and next September. Then I could send you a little gift picture.

PLAYING THREE DEEP
Township fair, Greig, Lewis County, 1916

Let me suggest what you might write in each of the letters. Of course you can take anything else you like but before you write the first one I wish you would go to the door of your schoolhouse or your own home some spring morning, and stand still for five minutes, using your eyes with all your might. Then go and sit down and write me a letter telling me everything you saw while you stood there. I wonder what you will see.

Write the second letter in early summer, June would be a good time. Go out into an orchard or a meadow and lie on your back in the grass. While you lie there, listen to every sound. Then when you get home, write and tell me everything you heard. What will you hear?

In the middle of the summer write again. This time tell me what you are doing. It might be a good plan to take some one day and tell me about it from the time you opened your eyes in the morning until you closed them again at night. What interesting reading that will be.

Remember, I shall be waiting for your letters. Now, let's go for a walk with Rover. He enjoys it as much as we do.

Your friend,

Edward M. Tuttle

A SCHOOL THAT IS REAL

District 5, Town of Plattekill, Ulster County
Ardonia, New York, January 16, 1917

Dear Mr. Tuttle:

As this is the first letter that has ever been written from this school I am going to tell you as near as I can about our school and school work. We have an attendance of about thirty children.

THE BOYS REMOVED A STONE FENCE TO MAKE ROOM FOR THE PLAYGROUND

We have a bird club which we call the Ardonia Audubon Club. We have the meetings the first Friday in every month. Sometimes we prepare a program to give at the meetings. We have birdhouses and feeding trays in the trees about the school. On Bird Day we take our lunch and spend part of the day in the woods.

We received first prize of a nature library for having the best school grounds. We also have a play apparatus which was put up by the boys with the aid of the trustee.

We have an organ which was bought by the Mothers' Club.

The older boys built a playhouse from a large box. It was then furnished by the boys and girls, even to the designing of the wall paper. The furniture we made from cornstalks.

We have a miniature store of Armour's products. Sometimes the lower grades are given lessons on giving the right change, one child acting as clerk and another as cashier.

Our school had the champion speller out of a town of eleven schools. There are many pictures in our schoolroom. Among the best are "The Spirit of '76" and "Sir Galahad."

THE LOWER GRADES PLAY AT STOREKEEPING

We have about forty industrial exhibits. We also have many good books which we bought with our entertainment money.

The girls fixed up a small closet for a first aid room with the cot and medicine cabinet. The girls act as nurses with one girl as head nurse. The boys fixed the coal bin as a workshop. They made the bench. There are many tools with which they can work. These we bought.

THE COOKING CLASS

About every three months we have birthday parties for the children whose birthdays come in that time.

We have hot chocolate and toast every day.

We enjoy reading your leaflets very much and are always glad when they come.

Sincerely yours,

ELLA BARCLAY

Editor's note.— What a wonderful thing it must be to go to school in District 5! Surely Ella and her schoolmates are happy in all the interesting things they have to do and are growing day by day in strong and wholesome ways. Just read over the list again: the bird club, the field trips, the playground apparatus, the organ, the playhouse, the exhibits of manufactured products, the storekeeping, the pictures, the library books, the workshop, the first aid room, the birthday parties, and the noon lunches, which have since become regular cooking classes. It is fine to have the pictures to go with this letter.

LESSONS IN FIRST AID

Does the thought enter your mind as to whether Ella and her companions do their regular studies when they have so much else on hand? Of course they do, an-

all the better because they are more wide-awake and interested in everything. They are not worrying about examinations. They are learning something every minute. They know that they can pass examinations because they can think for themselves. This is a story of what every school may become, a place of activity that is real, that is useful, that is interesting; a place where books are read and studied because they contain information that boys and girls know they want; a place that brings out all that is best in teacher and pupils, makes them believe in ideals and live up to them; a place that is building good men and women, good citizens of the community, of the State, of the nation, of the world. In the present time of sacrifice and struggle such a school will have a great influence because it stands for doing and being one's very best all the time.

OTHER LETTERS FROM BOYS AND GIRLS

District 2, Town of Romulus, Seneca County
Hayts Corner, New York, January 6, 1918

Dear Mr. Tuttle:

This morning as I was reading one of your letters I happened to think to write.

In our school we have three new scholars.

Friday afternoon we clipped up rags for pillows for the Red Cross. All of the scholars in our school have joined the Red Cross.

We like to work for the solidiers. We have a service flag up with three stars on it.

Every morning we salute the flag and sometimes we sing "America" and "Columbia, the Gem of the Ocean."

We had an entertainment for the benefit of the Red Cross. We cleared $12.50.

We have nature study. We haven't got our leaflets yet but we can't wait until we get them. I am buying liberty stamps to help the war out.

My father is in the next draft but I hope he won't have to go.

Well, I expect to hear from you soon.

Your friend,
CARRIE DEAL

Editor's note.—Carrie's letter shows how the rural schools are helping in the war crisis. There are many things that boys and girls can do as school groups and individually. It will take time to find the best ways to work out some kinds of activity, and letters and photographs telling of things that you have done successfully will be very helpful. Of course, we all hope, as Carrie does, that our fathers and our brothers will not have to go to war, but, if they are needed, there will be no word of protest or complaint. That is the true spirit of America.

District 5, Town of Tuscarora, Steuben County
Addison, New York, May 29, 1917

Dear Mr. Tuttle:

I have received your March leaflet. I read your letter this morning for my reading lesson. I am glad you said "It is only the ignorant who see no more to know," because I told my teacher that I had all the education I wanted. But when I read your leaflet I changed my mind. I think there is a lot more to learn.

Last month I built a birdhouse. It is about nine inches long and four inches wide. It has a peaked roof. I am eleven years old. I think this is the third time I have written to you. Last Arbor Day we cleaned up the school yard and set out some trees.

Sincerely yours,
CLAYTON ALBEE

Editor's note.— We are all glad that Clayton changed his mind, although we can understand just how he felt. It is sometimes hard to believe that it is more worth while to keep on with school than to go to work at something else. But every person who has given up school early wishes later that he had not done so. That ought to help us to hold on over the hard places. There are hard places everywhere in life, outside of school as well as inside, when we grow older as well as when we are young. It is a great thing to acknowledge frankly when we have been wrong. That is half the battle of getting right again. Clayton will win through.

District 4, Town of Canandaigua, Ontario County
Canandaigua, New York, March 28, 1917

Dear Mr. Tuttle:

I have read your leaflets and I am very interested in them, I am going to tell you something that may interest you. When I got home last night mother had churned. I asked her if I could fix it. She said that I could. I combed my hair and washed my hands and cleaned my finger nails and put on a white apron. First I got the butter bowl and scalded it and then I put some cold water into it. Then I took the butter up and put some cold water on it and worked it over. Then I poured the water out and put in the salt and worked it over. I then put a paper over it and let it set. Just before I went to bed I worked it over again and put it in a crock. If this interests you as I hope it does, I will write about maple sugar. I will close hoping to hear from you.

Your friend,
ABBIE JOHNSON

Editor's note.— Probably many of you girls and boys, too, have worked butter for your mother. Have you always been as careful as Abbie was to be very clean and neat before you touched it and to keep all the utensils clean and sanitary? This is a fine lesson!

REMINDERS AND SUGGESTIONS

"IT SEEMS to me," said the owl, "that there must be a good many things to say to the boys and girls after waiting a whole year since the last leaflet." And so there are.

TAKE THE LEAFLET HOME

When you have finished using your leaflet in school take it home. Show it to your father and mother. Ask them to read parts of it with you. Talk over with them some of the things you would like to do and get their help. If you are really in earnest, they will be glad to give it. Ask them to read for themselves the story on page 424. It has a message for them.

ADVANCED LIST

Every boy and girl who leaves the rural school or graded school to go to high school or to work should be on the Advanced List. Those of them who are interested to receive the leaflets personally during the next few years should write to the Editor Cornell Rural School Leaflet, College of Agriculture, Ithaca, New York, and ask to be placed on this list. The following letter shows how one boy keeps his interest.

Advanced List Letter

Albany, New York, December 17, 1917

Dear Mr. Tuttle:

I have been out of school for two years now and have been working on the farm.

I have to care for about one hundred and fifteen pigs so I don't have much time to play.

I wish you would send me all the bulletins and Rural School Leaflets you can spare. If you have them I wish you would send the school leaflets from March 1916 on; I also wish you would tell me where to get the reports of the Commissioner of Agriculture. The last one I have is a green-covered book about two inches thick for 1912 and 1913.

I know this is asking quite a little, but I like to read that kind of thing. As I have made my "short" letter plenty long enough by this time, I will close, intending to write again in the near future.

Yours truly,

CHARLES ZIEHM

Charles was put on the Advanced List for the Cornell Rural School Leaflet and sent the back numbers. He was sent a list of the other publications of the College of Agriculture with instructions to write for those that he thought would be helpful to him, and he was told to write about the report to the Commissioner of Agriculture, Albany, New York.

THE BLUE JAY

You will want to keep the blue jay picture smooth and clean. Couldn't you frame it in some way? Get a piece of cardboard, a piece of glass, and some passe partout tape and go to work. Hang it in your room where the other bird pictures that you have received are hanging, too, perhaps.

THE YEAR'S WORK

It is a long time now since your teacher received the September leaflet, telling of the birds, animals, insects, plants, and trees for study this year. No doubt you have been keeping your eyes and ears open, with good results. No doubt you have done and are doing many things such as building birdhouses, keeping a bird calendar, having some animal visit the school to be studied or going to study it in its own home, keeping poultry or dairy records, watching the insects, identifying and pressing plants that you collect, studying weed seeds, planning your garden, making a tree mount, learning to tell the different tree twigs apart, preparing warm noon lunches, sewing, taking trips through fields and woods, and oh, ever so many more things — too long a list to write down. These are the joys of living in the open country, where every minute something is going on that is interesting if we only know about it, where there are so many chances to do useful and pleasant things. Try to make every day count. Take a minute each night to look back and see what you have learned new that day which you are glad to know and to remember. It is the common things around us, after all, that can teach us most. In one way they are not so common as we sometimes think.

PLAY

You will not find any new games in this leaflet. So much else needed to be said that they were crowded out. You will not miss them greatly because you are learning new games all the time from your physical training supervisor. With all the things the boys and girls are being asked to do these days, in the spirit of service, no one thinks for a minute that you should not have time for play. Remember what your new song says: "Play we enjoy all the better, when we have labored so long." You are going to learn how true this is. You are going to grow "cheerful and happy, active and strong." Work when you work, play when you play.

Just a word about your play. Always play with spirit; always play fair; always think of the other fellow. This is a great crisis in the history of the world. It is going to be straightened out by people who can pull together in a right cause. The idea of teamwork can come to boys and girls through play better than in almost any other way. Be a good member of a good team.

ARBOR DAY

In the midst of all the new things that boys and girls will find to do because of the war, they should not neglect their schoolhouses. Something should be done this year, as every year, to make the grounds more pleasant and attractive. A few shrubs in the corners, around the building, or about the outbuildings, a vine or two for the doorway, a new tree if one is needed, care of the lawn — all of these are within reach by a little time and thought and effort. It is easier and happier to live and work where your surroundings are pleasing. You can help to make them so.

THE NEW SONG

You will find the new song on page 421. *Busy Children* is going to become one of your favorite songs. It is the best song of country life, work and play, that could be found. In an old collection, published by a firm no longer in business, it came to light with nothing to show who wrote either the words or the music. But some one knew what boys and girls are doing to help in their homes, and some one knew a song with a good swing to which to set the words. Learn to sing it, one and all. If you have no piano nor organ at the school, meet some afternoon in a home where there is an instrument and practice it. Sing it all summer long as you work in the fields, in the barn, in the house. Make it a song of service.

WRITING LETTERS

Every one enjoys a friendly, interesting letter. We all have a habit of watching for the postman. Why is it? Isn't it because we expect that he is going to leave a message for us from a friend? To deserve letters we must write them. It is not always easy to write them, but it is always worth while. The more we can imagine when we are writing that we are just talking to our friend in the same room, the better our letter will be. Some of you have written to Mr. Tuttle many times. Others have started letters and never finished them, or finished letters and never mailed them. Next time be sure to finish and mail your letter. You will be glad afterward. Perhaps you will receive an answer. If you write three times you will receive a gift picture. It is an interesting picture this year. Do not forget on every letter you send to the College to put your school district number, township, county, and post office address. Do this even if you

write in the summer when school is closed. It is the only way to make sure that your letter will be given credit.

But there are even more important letters for you to write now. Perhaps some one you know is in the army, away from his home and friends. He gets lonesome at times. What a pleasure it would be if he could have letters from you now and then. Even though you do not know him personally, if he comes from your district, write to him telling him the home news and your own doings. It would be fine to do this as a school for all the men who have gone from your neighborhood. Here is a chance to do something in the true spirit of service.

EVERY RURAL SCHOOL CAN BE MADE MORE ATTRACTIVE BY PLANTING SHRUBBERY
District 9, Town of Canandaigua, Ontario County

A SERVICE FLAG

You have all seen the service flag. It has a red border, a white center, and blue stars on the white field — one star for each man in service. Every school should have a service flag showing a star for each man in the active service of his country who graduated from the school. This will take a little searching into history that will be interesting and worth while. Look up the records, talk with your parents and neighbors, and make a service flag to hang on the wall, or in the window, or to fly on the pole beneath the stars and stripes.

SAVING MATERIALS

If the war goes on for a year or two more, we shall have to use all our resources, old and new. Scattered over the land in homes and around

homes, there is much material that one of these days it will pay the Government to have collected. Such things as newspapers and magazines, rags and cast-off clothing, old knitted yarn garments, bottles, tin cans, tin foil, rubber, and old iron will be needed. Boys and girls in country districts can begin now to collect these things and to store them somewhere in the community. In most cases the question of disposing of them at their just value must wait a little until the proper means are found and the railroads are not so burdened, but "a stitch in time saves nine;" so be ready for the call when it comes. Find an empty shed or building somewhere and make it a storehouse. Keep everything you gather sorted and bundled up as much as possible. Have a record of what each one in the school does in this work. Use your odd moments for it. Write to the College when school opens next September and make a report of what you have collected.

RATS AND MICE

. This is a special word to the older boys. One great source of loss of the goods and materials that men labor to grow and manufacture is due to the destruction caused by rats and mice. Everywhere they abound, in country, in village, and in city, and in the course of a year do millions of dollars worth of damage in the United States. There is only one way to overcome this loss, and that is to destroy the rats and mice. This is a case where animal life must be taken for the protection of man. Very often grown people are too busy to appreciate the need of prompt action against these creatures. They are allowed to gnaw away until they become very conspicuous before action is taken. In the meantime the damage is serious. You older boys can take a hand in this. Barns, mills, granaries, corncribs, and even houses in your community may be infested. Begin at home, but once cleaned up there get permission to do the same for your neighbors.

Here are a few points about methods. Persistent use of traps is usually superior to the use of cats and dogs, and besides the traps do not eat while they work. Poison is not to be recommended except in special cases where there can be no possible damage to other animals. Several kinds of traps must be used alternately. The rats are quick to sense danger and will avoid a trap with which they have become familiar. When rats are caught alive they should be killed in the quickest and most humane way. Drowning is perhaps best. A very complete discussion of this whole matter is contained in Farmers' Bulletin 369, *How to Destroy Rats*, published by the United States Department of Agriculture, Washington, D. C.

BUSY CHILDREN

FAIRS AND EXHIBITS

Many opportunities come during the year to display your work and the things that you have learned. There are the county fairs, the state fair, township and supervisory district school fairs, local fairs at your own school, Corn Day, Farmers' Week at the College of Agriculture, and others. Use them as much as you can. It helps us all to know what each is doing. From seeing and hearing what others have learned we gain the inspiration to go and try ourselves. When simple awards are given for the best work, it pleases us if our efforts have proved worthy.

BE SURE TO HAVE A FAIR AT THE SCHOOL NEXT FALL
District 10, Town of Newfane, Niagara County

The Farmers' Week exhibit this year was very fine and attracted a great deal of attention from the visitors. There were not so many entries as last year, but the quality steadily improves. In all, two hundred and fifteen schools were represented. The plan of sending each school a certificate has worked out well. The schools that won the grand sweepstakes prizes for the whole State were: first, District 4, Town of Bath, Steuben County, 57 points; second, District 10, Town of Newfield, Tompkins County, 24 points; third, primary room, District 8, Town of Newport, Herkimer County, 23 points. This year it has made a difference not to have the customary November and January leaflets. Still you can remember from year to year that Farmers' Week is

always held and that material for the school exhibit should be sent to reach the College on or before the last day of January. Begin now to plan and make something to send next year, selecting from the list on page 306 of the September teachers' leaflet.

THE SPIRIT OF SERVICE

In all the days ahead try to live each one the very best you know how. Keep well and strong, busy and helpful, thrifty and saving, unselfish and generous, cheerful and happy. Be loyal to your country, to your State, to your friends, to your home, to yourself. Have high ideals and live toward them. Learn to give justice to every man. Believe that it is "more blessed to give than to receive," and that when one thinks of others before himself he grows to be very happy.

In your school band together, one and all, for service. Whatever you may call yourselves, whatever you may be asked to do, for the Junior Red Cross, for war savings, for producing, saving, and giving — do it all as with one impulse, do it all in the spirit of service.

THE QUESTIONS ANSWERED

You will remember that last year three questions were asked with the promise to print the best answers. They were not easy questions and required some study in books, some talk with persons of experience, and some first-hand observation to answer correctly. Many of you wrote, and a good number of you were right in one or more cases. The letter that seemed to give the most complete and correct answers is printed below so that you may all have them. Do not stop with reading these answers; try to convince yourself that they are true by studying on your own account. Especially would it be interesting for you to make some observations on the question of the birds' eggs and to keep a record of what you learn this summer. Be careful in all such work not to disturb the birds.

Here is the letter:

District 3, Town of Newfield, Tompkins County
West Danby, New York, June 6, 1917

My dear Mr. Tuttle:

In your November leaflet you requested an answer to three questions:

1. Does an earthworm lay her eggs in the ground? How large are they and what color?

2. What is in a cow's udder before the cow is milked?

3. Do all birds take the same length of time to hatch their eggs?

In school we have studied the cow, the birds, and the earthworm in connection with our nature study, and I will submit the following answers:

1. Notice that the earthworm has a swollen area about one-third the distance from the front end of the worm, called the girdle. This girdle is a sack in which the eggs are laid while in the body of the worm. It is gradually worked forward and as it goes over the head the sack ends snap together enclosing the eggs in a capsule. In summer these capsules may be found in manure heaps and under stones. They are small yellowish or brown bags about the diameter of a worm.

2. Milk is manufactured in the udder from the blood. The fresh blood is brought to the udder directly from the heart by arteries. As soon as the blood reaches the udder the manufacturing of milk begins. It is most rapid while the cow is being milked. After the constituents for making the milk are taken out, the blood is drained away by the milk veins. Consequently, there must be both blood and milk in the udder before the cow is milked.

3. All birds eggs do not require the same time for hatching. The period of incubation varies with the species. The eggs of the smaller birds require from ten to fifteen days in which to hatch, while those of the common fowl require three weeks, and those of the turkey and most water fowl require four weeks. Larger eggs take longer than smaller ones.

I am fourteen years old and earned my preliminary certificate in January. Since then I have been doing high school work until May when I left to assist my father on the farm.

We keep a good dairy and do the work on the farm with my brother's help.

Sometimes I get quite tired, but it rests one to see the crops thrive.

I wish to send in my name and address for the Advanced List.

Miss Snyder, our teacher, often speaks of you in school and has said several times that you were coming to see us. I hope you will surely come this year.

I thank you for the leaflets. We enjoy them because we get the experiences of other pupils, and that gives us an opportunity to make progress.

Yours truly,

FRED BUTTON

THE PARENT SPEAKS

This morning I stood in the doorway and watched my boy and girl trudging down the road toward the little schoolhouse in the distance. The thought came to me with greater force than ever before of how utterly my life is wrapped up in theirs. The years go by very swiftly, and it seems but yesterday since they were babes in arms. Yet here they are sturdy, happy youngsters, going to school.

I wonder about that school they are going to! To be sure, I have been in the building; I have met this year's teacher; I have paid my taxes promptly although, I admit, with a grumble at the amount. But how much faith have I in the school? What is the school doing? What should it do? These are big questions, too big to be passed over lightly. This morning as I stood in the door — with my country and the whole world at war — I tried to answer them truthfully.

It is strange that there should have come into my mind at that moment memory of an experience I had about a year ago in buying furniture. We needed a dining-room set — table and chairs. It finally came to a choice between two sets that looked very much alike, only one cost almost twice as much as the other. The clerk said that the more costly one was of solid material carefully put together, that it would last a lifetime, while the other was cheaply and poorly made and would last only a few years. But, it looked good, and, while I respected the clerk for his frankness, I didn't quite believe all he said about the second set. So I bought it. To-day, after just one year, I know that the clerk was right. That dining-room set is a sight. It looked fine when we put it in, and we congratulated ourselves that we hadn't spent the extra money for the other set. But it wasn't long before some of the chairs weakened in their joints and got wobbly. Then the table began to chip, revealing only the thinnest kind of veneer. I wish you could see them now in spite of all the time we have spent patching and mending. We don't feel like buying another set so soon; so we must get along with this one for a while, but we are ashamed of it and hope that visitors when they come won't notice.

It struck me all of a heap this morning that buying education is like buying furniture. There are two kinds. At first glance they look very much alike. Only one costs more than the other and lasts a lifetime. The cheap one soon wears out and we are ashamed. The only difference, and I confess it is a very great one, is that while after a time the cheap furniture can be thrown aside and more purchased, the person who has had a cheap education can't throw it aside or make any substitute. He has to live all through life with his cheap outfit, patching it up as best he can, sick at heart over it all. And, in his case, the fault is not his, but that of his parents. They chose his education. They decided to take the cheaper article that looked just as good as the real thing. They saved a penny and ruined a life.

That is a tremendous thought. When I really face the facts, is there anything I want more than that my son and my daughter shall have the very best opportunity in life? Is there any material thing I want more than that — house, or clothes, or land, or money in the bank? Of course not. Yet as I look back I have a feeling that there have been times when I acted as though education was the last thing I felt like putting money into.

It is interesting how things fit together when one gets to thinking about them. I have just picked up a paper and read the following paragraphs written by Herbert Fisher, who is at the head of education in England:

> That nation which, after the war, employs the best teachers with the highest pay and as a part of the best school system, will be the best governed and, therefore, the greatest nation. Of that I am absolutely

certain. No people which does not respect education will demand and support good government, and if there is not a vital impulse running through its education, the people of no nation can be expected to respect it.

I believe, and an increasing number of other people are beginning to believe, that education lies at the root of happiness for every people. Worthy education is impossible when inferior teaching forces are employed and only inferior teaching forces can be secured where inferior pay is offered. Where teaching is inferior, good government cannot be expected.

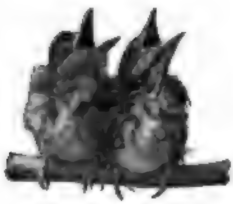
Mr. Fisher and our own leaders in this country, are like the furniture clerk. They are very frank about the two kinds of goods, yet they can only state the facts. I make the purchase and pay the bill. After all, the cheap thing is more costly in the long run. It is going to be so with my furniture; it must be so with my children's education. The little school that I can see in the distance, and in which my boy and girl are sitting this minute, can be a better school in a hundred ways; it should have in it for teacher the most human, broad-minded, trained person we can find. Then education in that school will be real, not veneer. In the future I am going to have the courage and the wisdom to buy the genuine article and pay the price.

MY CREED

HOWARD ARNOLD WALTERS

I would be true, for there are those who trust me,
I would be pure, for there are those who care,
I would be strong, for there is much to suffer,
I would be brave, for there is much to dare,

I would be friend to all — the foe, the friendless,
I would be giving and forget the gift,
I would be humble for I know my weakness,
I would look up and laugh and love and lift.



SUPPLEMENT TO

CORNELL RURAL SCHOOL LEAFLET

VOLUME XI ITHACA, NEW YORK, MARCH, 1918 NUMBER 3

SUMMER SCHOOL AT CORNELL UNIVERSITY

As one of the results of the war, the work of our schools is being connected with the life of community and state as never before. Only the progressive teacher is able to keep abreast of the movement. For this reason you will be interested in the Summer School of the New York State College of Agriculture at Cornell University. The courses that are to be offered have been planned for the distinct purpose of assisting those who are working in the rural schools to vitalize their work by relating it to country life and problems.

Courses in the following subjects are suggested for those who wish to more adequately prepare themselves for their work as country school teachers: nature study, rural education, physical education in the one-room school, elementary woodwork, gardening, and home economics in the country school.

In addition there are very complete courses laid out for persons who may desire to prepare themselves for positions as supervisors of school and home gardening, and physical training. There is also a variety of courses for those who do not have the specific interests indicated.

Each year there has been a fair attendance of rural and training-class teachers, but the number should be much greater. There should be at least one teacher from each supervisory district in the State as there is no tuition charge for residents of New York State.

If you are interested, write to the Department of Rural Education, College of Agriculture, Ithaca, New York, for more complete information.

CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK

A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 126 JULY, 1917 LIVESTOCK SERIES

SWINE PRODUCTION IN NEW YORK

H. A. HOPPER

BERKSHIRE SOW

Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

CORNELL READING COURSE FOR THE FARM

Some knowledge may best be learned from experience, but frequently, as Benjamin Franklin said, "Experience teaches a dear school." The objection to "book learning" is passing, because it is necessary to learn by reading as well as by doing in order to solve some of the difficult modern farm problems. Reading reliable agricultural publications not only helps in increasing profits, but also adds to the interest and satisfaction of farm life. In order to meet the need for special series of lessons for home study, the College of Agriculture established the Cornell Reading Course for the Farm, which brings consecutive instruction by the College to the farm. Enrollment in the reading course is free to residents of New York State. The reader receives the available lessons on the subjects in which he is particularly interested, and also the new lessons issued monthly. Further information appears on the attached discussion paper.

Three advanced reading courses have been instituted in farm crops, fruit growing, and vegetable gardening, to provide instruction in accordance with modern correspondence methods, but without college credit or certificate. Careful supervision is given to advanced readers, and regular and conscientious work in reading, performing practical exercises, and preparing reports is expected. Each report is corrected, graded, and returned with criticisms and suggestions. The expense connected with each course is the cost of textbook, materials for practical exercises, and postage, which will amount to about $3.75.

In a number of communities groups have organized for the discussion and study of common problems, and have adopted the name Cornell Study Club. The primary purpose of a Cornell study club is to furnish an occasion and an incentive for discussing reading course lessons for the farm and for the farm home, but the objects include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. Cornell study clubs are educational and social centers, and should develop local leadership and the human resources of the community. The men and women usually hold the opening numbers of the program together, separate for group discussions on agriculture and home problems, and join later for a social hour. If preferred separated clubs of men and women may be formed. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College.

ROYAL GILKEY,
Supervisor of the Cornell Reading Course for the Farm.

SWINE PRODUCTION IN NEW YORK

H. A. Hopper

Livestock must hold a place of increasing importance on farms in New York State. Efforts to conserve farm resources more completely should take into account the immediate profits and the constructive results of a well-balanced livestock industry. Swine husbandry on some farms in this State is a neglected industry. A correction of present abuses and a high appreciation of the value of swine on most farms as a source of revenue are greatly to be desired at this time.

Frequently useful residues and by-products go to waste, which might, with a little effort, be converted into pork. The possibilities of using these should be carefully studied on every farm. Obviously, the farmers of New York State cannot compete with pork producers in the Corn Belt, where both forage crops and concentrates are more abundant and cheaper, but it is not for this purpose that an aroused interest in swine production in New York is deemed advisable. There is much farm waste in this State that should be utilized, and it is incumbent upon the farmers to market some of it thru swine. Corn is not indispensable to profitable pork production. Denmark does not produce corn tho it is a great producer of pork and bacon.

A growing interest in swine husbandry in New York State is traceable to two things: higher prices for swine and their products, and a realization that the keeping of a limited number of pigs may tend to diversify the farm business. While possibly not every farm should have pigs, it is hard to conceive of a well-balanced farm without some pigs. Aside from any commercial considerations, the renewed interest in the home curing of meats for family use would point first to the pig as a source of supply. It is appropriate, therefore, to study closely the place of the pig in the farm management scheme. Americans are the greatest meat eaters in the world. So far as is economically consistent, this demand should be supplied with home products.

STATUS OF THE SWINE INDUSTRY IN NEW YORK

According to the agricultural census of 1917, there are less than 500,000 head of swine on farms in New York State. To this number should be added about one-half of one per cent to represent the numbers kept elsewhere. Since the hog is a prolific animal of relatively short life, the numbers are subject to rapid fluctuation in response to market and other conditions.

There are about 200,000 farms in the State. One-half of the farms report no pigs whatever; the other half have an aggregate of four pigs each. There are less than two brood sows on twenty per cent of the farms, and only thirty-three per cent have pigs other than brood sows. In general the counties with the largest numbers of dairy cows have the most swine.

In comparison with the census report of 1910, the report of 1917 indicates a decline of about twenty-five per cent in the number of swine kept on farms in the State during the past seven years. Advancing prices for pork products, as well as for supplementary concentrates, during recent years, have encouraged liquidation. With the prospect of continued high prices for supplies and pork products, the need for readjusting conditions of production in this State becomes apparent. In this connection the cooperative development of local marketing facilities should not be overlooked.

ECONOMY OF SWINE

Practical observation has long indicated the striking economy of pigs, and careful research has abundantly confirmed it. Under the present stress for economical meat production, the growing of pigs should appeal to many who have facilities to care for them. "Pigs produce a pound of gain from 4 to 5 pounds of dry matter, while fattening cattle require from 10 to 12 pounds. The pig yields from 74 to 80 per cent of his live weight as dressed carcass; the steer only 55 to 65 per cent." When compared with sheep and beef cattle in the amount required for gain, the superiority of the pig as a meat producer is established.

PLACE OF THE PIG IN NEW YORK

The New York farmer should not aim to compete with the Iowa or Illinois farmer in producing pork. There are definite reasons why this is true, which may be found in the relative cost of transporting live hogs or the grain to fatten them from the West to the East.

If it takes a bushel of corn weighing 56 pounds to produce 10 pounds of pork, which is cheaper to ship to New York, the finished hog or the grain to feed him until he attains a weight of 300 pounds? The average price of corn for the five years previous to 1915 is 78 cents per bushel in Iowa. The average freight rate on corn from Chicago to New York is 9.08 cents per bushel and on live hogs 30 cents per 100 pounds. The cost then to ship a 300-pound hog from Chicago to New York is 90 cents, while the cost is $2.72 to ship the corn required to grow the hog in New York. On that basis the advantage lies with the western pork producer.

The New York farmer, however, does have some local advantages in pig production with which the western farmer cannot compete. On most farms there are wastes that only a hog can utilize. These, together with nutritious forage crops, may be used to produce a few hogs each year on most farms without the addition of a large amount of expensive grain. There is a growing demand at all seasons for fresh meat that can be marketed locally with little cost for transportation. The prices for hogs on eastern markets are higher on the average than prices for hogs on any of the western markets. Thru the utilization of dairy, orchard, garden, and kitchen waste, diversity may be obtained and returns

FIG. 1. CHESHIRE BARROW

increased. Within these lines there is opportunity, therefore, for the pig properly handled on many New York farms.

The main interest in swine husbandry in New York State probably originates in the desire to utilize various sorts of farm waste and by-products best suited to the growth and fattening of pigs. The swine industry is therefore likely to be incidental to rather than a main feature of the farm business. Even tho this is true, the need to study ways of properly conserving farm waste thru the pig is worthy of close attention. The futility of attempting to produce pork profitably when the animals are confined in pens or dry lots without forage crops and fed nothing but purchased mill feeds, is established beyond a doubt. In considering the question of conservation thru the pig, attention is turned first to the sorts and amount of available by-products to be fed.

FEEDS FOR SWINE

DAIRY BY-PRODUCTS AND THEIR USE

Since dairying is the leading agricultural enterprise of New York State, the dairyman's interest in pork production should be considered first. Where cheese factories and creameries exist, there are such by-products as skimmilk, buttermilk, and whey that may be returnable to the farm for feeding purposes. No dairy by-product from a cooperative or a central plant should be removed to a farm without first being thoroly pasteurized. This prevents the spread of a number of communicable diseases that otherwise would be easily carried by the raw by-product from farm to

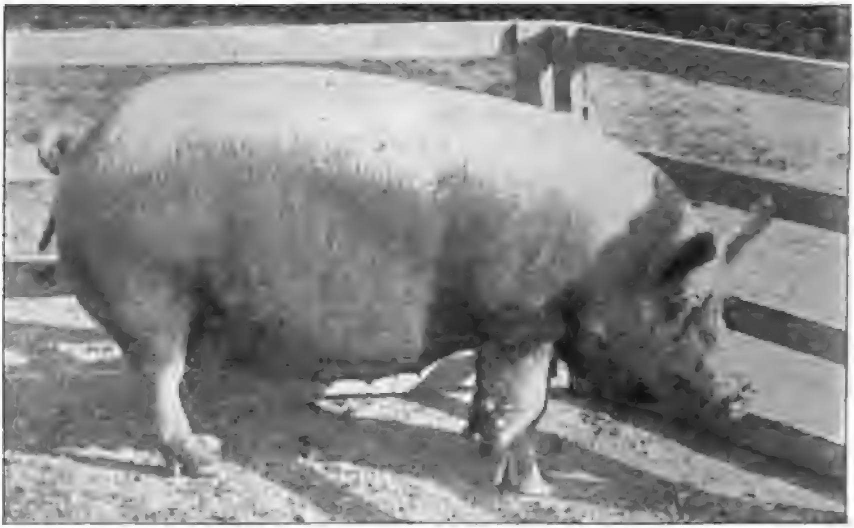


FIG. 2. CHESHIRE SOW

farm. Pigs following tuberculous cattle or fed on unpasteurized milk from cows suffering with tuberculosis, become affected with the disease themselves. However, with proper precautions dairy by-products can be used without harm and constitute a valuable source of revenue.

FEEDING VALUE OF SKIMMILK AND BUTTERMILK

Skimmilk and buttermilk are ideal feeds for brood sows and growing pigs. Since these feeds are rich in digestible protein and supply mineral matter in an efficient form, they are best fed in combination with carbonaceous foods. Corn, barley, or wheat when supplemented not too generously with skimmilk or buttermilk yield economical returns. With pigs weighing about one hundred pounds, a pound of cornmeal, or its equivalent, to about three pounds of milk has given most economical gains.

More milk may be fed to advantage to younger pigs if it is abundant, but the returns are not so high with older pigs as when the ration is more evenly balanced.

When in good condition and no water has been added, buttermilk is equal to skimmilk in the production of gains on growing pigs. In starting pigs on either buttermilk or skimmilk care should be exercised to avoid overfeeding. For very young pigs sweet skimmilk is probably preferable to sour milk. Certain trials have shown pigs getting sour milk to be more thrifty than those getting sweet milk. If the milk is wholesome, sourness is no objection. It should be the same each feeding either sweet or sour. Milk of either kind fed alone gives only about half as rapid gains as when fed in the ratio of one part of a good grain mixture to three or four parts by weight of milk. In a general way the money value of skimmilk when used with corn for fattening pigs weighing one hundred pounds or over is indicated in table 1.[1] With pigs weighing less than one hundred pounds the larger allowance of skimmilk should prove most profitable.

TABLE 1. Money Value of 100 Pounds of Skimmilk when Used with Corn for Fattening Pigs

Cost of corn		When one pound of cornmeal is fed		Average of all trials
Per ton	Per bushel	With 1 to 3 pounds of milk	With 7 to 9 pounds of milk	
$16	$.45	$.24	$.15	$.17
18	.50	.28	.16	.19
20	.56	.31	.18	.21
30	.84	.46	.27	.32

Whole milk rich in butterfat has been found unsatisfactory for young pigs. In comparison with skimmilk, whole milk is worth only about twice as much for general pig feeding. This in connection with the high market value of butterfat makes the use of whole milk in pig feeding impractical.

Buttermilk and skimmilk contain certain vital nutrients that such foods as middlings and tankage do not have. An almost negligible quantity of either, in addition to other balancing effects on the ration, may supply the necessary vital elements to promote complete growth in the young pig. Some milk fed at the right time may make the difference between a good pig and a poor one. A little milk works wonders in pig feeding. If the quantity is limited, it should be distributed among the

[1] This table is adapted from *Feeds and Feeding*, by W. A. Henry and F. B. Morrison.

young and growing ones, rather than given to a favored few. The high value of buttermilk when fed in small quantities to weanling pigs on a grain ration with tankage is shown in table 2, which is quoted from John M. Evvard.

TABLE 2. GROUPS OF WEANLING PIGS FED FOR 100 DAYS IN A DRY LOT

	Group 1 fed on shelled corn, wheat middlings, and tankage	Group 2 fed on shelled corn, wheat middlings, tankage, and buttermilk
Initial weight per pig, pounds	42	42
Final weight per pig, pounds	155	160
Average daily gain per pig, pounds	1.13	1.18
Average daily feed eaten per pig, pounds		
Shelled corn	3.40	3.54
Wheat middlings	.61	.44
Tankage	.62	.43
Buttermilk	None	1.84
Pounds feed required for 100 pounds gain		
Shelled corn	299.90	299.70
Wheat middlings	53.50	37.00
Tankage	54.60	36.00
Buttermilk	None	155.80
Cost 100 pounds gain, buttermilk at $.25 per hundredweight	$5.90	$5.58
Cost 100 pounds gain, buttermilk at $.455 per hundredweight	5.90	5.90
Profit per pig at $7 per hundredweight, buttermilk at $.25 per hundredweight	1.25	1.68

All these feeds were self-fed except buttermilk, of which each pig received not quite a quart once daily. Pigs had access to bone ash, charcoal, and rock salt, but ate very little; hence these items are not charged in this computation.

OTHER RESIDUES

On the farms of truck-growing and fruit-raising regions of the State there are varying quantities of waste material of relatively high feeding value for swine. Much of this waste can be conserved and fed over a considerable period, but a good part of it is very perishable. Many such farms may well plan to keep a few brood sows to furnish pigs to consume this material when most abundant. This should be a practicable scheme in view of the ease with which a mature brood sow may be kept from one season to the next.

Many pigs are fed largely or exclusively on waste from hotel kitchens, restaurants, or bakeries. Such wastes of a mixed character are likely to

be very nutritious, and, if in wholesome condition, the animals should thrive. Care must be exercised to avoid the admixture of soaps and washing powders likely to occur in dishwater. These together with salt in excess will be likely to prove fatal to pigs. Residues from cracker factories and bakeries need to be supplemented with protein feeds as they are too carbonaceous.

There is serious danger that pigs may contract disease or meet death from the presence of injurious substances when fed on garbage. For this reason, the sows and pigs used in such an enterprise should be well inoculated with hog cholera vaccine. In spite of every precaution the difficulty of excluding all foreign substances and poisonous materials renders the undertaking hazardous.

PASTURE AND FORAGE CROPS

Under any conditions, the cost of pork production is materially reduced by the use of pasture and forage crops. For satisfactory results it is usually desirable to supplement these feeds with some grain, especially when the animals are being finished for market. Exclusive pasture even of good quality is hardly sufficient for the young and growing pig. While the value of pasture and green forage for pigs in New York is generally recognized, it is not given the attention that its importance demands. Close yarding and a ration of expensive purchased concentrates cannot prove profitable. A life of comparative freedom, in contact with the soil and with access to fresh, green, nutritious crops, furnishes the elements for profitable pork production. The owner or operator controls these factors; therefore it rests with him to make the pigs pay as they should.

RYE AND WHEAT

For late fall and early spring pasture, rye and wheat are valuable. In this State, they should be seeded usually late in August and will thus make fall, winter, and spring pasture for pigs. Pigs should begin to pasture cereal crops when the plants reach a height of six to eight inches, and should be taken off when the plants become so mature that the pigs begin to spit the chewed material from their mouths. Green wheat, oats, rye, and barley, when fairly mature, are classed as carbonaceous, but in their early stages of growth they are nitrogenous. Since they are but slightly affected by frost, they are the most useful crops for pigs during late fall and early spring.

THE GRASSES

Bluegrass and other natural pasture grasses are satisfactory for spring and early summer until drought retards growth. With the exception of rye, bluegrass furnishes the first green feed in spring, and it should be

fully utilized. With the advent of hot weather, however, hogs should have access to other forage crops, as bluegrass will not be available until revived by the fall rains. Orchard grass, especially in shady pastures, comes earlier than bluegrass, and is fairly good for pigs.

CLOVER

Whether clover is a satisfactory forage crop depends largely on the season, success in getting a stand, and the stage of maturity when fed. In combination with corn, clover makes one of the best feeds for cheap pork production. In view of its tendency to kill out, clover fits better in a rotation with other plants than in intensive plot culture. The usual cultural requirements for this crop should be followed in attempts to use it in New York. It is relished by pigs and can be harvested by them to advantage by the use of hurdles or temporary fences.

SWEET CLOVER

Sweet clover, which until recently was looked on as a weed, is coming to be recognized as having a wonderful value as a pasture or forage crop. It suffers little from drought, and stock, especially hogs, do well on it.

There are three common species of sweet clover, one of which, *Melilotus alba*, the white-flowered sort, is preferred for most purposes because of its sturdy vigorous growth. It can be seeded almost any month of the year, and prefers a hard seedbed and rather scant covering of the seeds. If covered too deep, it will not germinate. Sweet clover seed germinates with difficulty because of an impervious seed coat. A machine called a scarifier has been perfected, which abrases the seed and thus insures higher germination. Seed sown in winter need not be scarified. The seed should be applied at the rate of ten pounds per acre. Inoculation of the soil and applications of lime are recommended.

ALFALFA

Alfalfa is probably not widely enough grown in the State to be a real factor in pig feeding, but its merit is established beyond question. Since it is a legume rich in protein, it has the same value as clover, vetch, and the like in hastening maturity and reducing the need for nitrogenous concentrates. It will not endure heavy pasturing. It should be stocked to about half capacity and the new growth cut regularly for hay. A good stand will produce four hundred to five hundred pounds of pork per acre.

CANADA FIELD PEAS

Canada field peas sown with a cereal, such as oats or rye, make an excellent early forage crop for hogs. The seed should be sown early and covered deeply to insure the best growth. When possible a moist, cool,

well-drained soil should be selected. The crop grows rapidly under right conditions and will be ready for use in early June in conjunction with or following clover. This mixture is usually sown at the rate of one and one-half bushels each of the peas and the cereals used. On heavy soil the crop may lodge, but pigs will clean up the vines and peas well with little waste. The crop comes to maturity quickly as hot weather approaches, so that to insure best results two or three small areas should be planted at intervals of about ten days. Feeding these off in succession gives an extended period of uniform forage. The bacterial inoculation of the field pea is recommended.

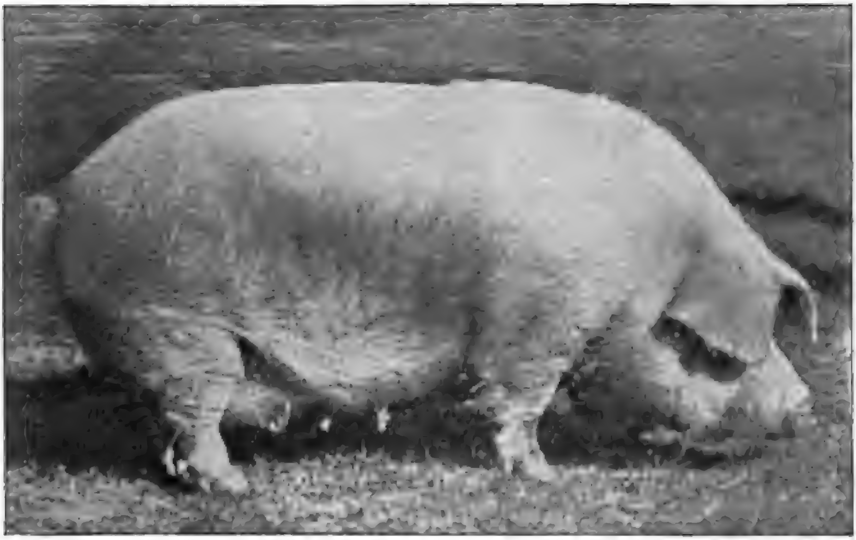


FIG. 3. CHESTER WHITE SOW

HAIRY VETCH

Hairy vetch is a biennial legume of increasing importance as forage for swine. It should succeed wherever field peas do well, but as yet the latter are preferred. In many parts of New York hairy vetch thrives, and its use as a forage crop is increasing. Vetch may be planted in the summer or the fall with rye and thus furnish valuable pasture the following spring. The seed or the soil should be inoculated to insure full growth of vetch.

DWARF ESSEX RAPE

The rape plant as a forage crop for hogs is highly recommended wherever grown. When planted in the spring it is ready to pasture in six or eight weeks. In this climate it will not survive the winter. It is recommended that rape be planted in small areas at intervals of two or three weeks. About three plantings should be made. The Dwarf Essex variety is in

highest favor and is sown in drills twenty-eight inches apart at the rate of two to four pounds to the acre, or broadcast at the rate of four pounds to the acre. For fall feed, it may be sown in corn at the last cultivation.

When pigs are put on rape, it may take them sometime to develop a taste for it; young pigs do not make so good use of rape as the older ones. The plants on the first plot seeded should be fifteen inches high before the pigs are turned in. The rape stalks should not be too closely pastured, for they will grow up again while the later seeded plots are being used.

For less intensive feeding, where fewer animals are to be kept per acre, rape is sometimes sown broadcast with oats and clover at the rate of four pounds of rape, eight to ten pounds of clover, and one bushel of oats per acre. In this mixture eight to ten pounds of sweet clover could be used, and excellent pasture maintained a second year. The pigs should not be turned into this until the crop is from eight to ten inches high, after which each acre with a good stand of the crop will supply fifteen spring pigs with forage for the rest of the season. Under favorable conditions rape will produce four hundred to five hundred pounds of pork per acre during the season.

OTHER SEEDING MIXTURES

In addition to the forage crops already mentioned, there are other valuable seeding mixtures used. Local practices may offer excellent suggestions. Pumpkins and roots yield valuable crops that pigs may well harvest. Most of the green forage crops, especially if they contain a legume, may be depended on to cut down the grain required to grow and fatten a pig at least twenty-five per cent.

The eastern hog feeder has been slow to recognize the value of forage crops for hogs and the advantages incident to permitting them to harvest crops for themselves. Western feeders commonly practice "hogging down" the corn crop. Easterners have been slow to accept this practice, as a high value attaches to the stalk for other purposes. Aside from this fact, the practice is not wasteful where labor is expensive. It will probably pay even in New York to let hogs harvest part of the grain in the form of corn designed to finish them. If soybeans are planted with the corn, the pigs will harvest each crop and in a measure be able to balance their own ration.

PRECAUTIONS

Pigs given access to green forage are usually more thrifty and make faster gains than those handled otherwise, and, if wisely managed, there need be no waste. In order to get best results the crop should be carefully seeded, fed when ready, never overstocked, nor needlessly trampled when the ground is wet. An acre of these crops can be so handled as to supply forage from June until October for fifteen to twenty spring pigs.

The pigs should not be turned in until the crop has a good start and should be taken out for a few days after heavy rains, as the pigs may do great damage by trampling and rooting the crop.

GRAIN ON PASTURE

While the cost of pork production is reduced by the use of green feeds, an addition of grain is desirable. The pig is omnivorous, with small capacity for exclusive forage feeding. Grain gives best returns when the pig is young and on pasture. From one-half to three-quarters of a grain ration should be allowed at this time.

Young growing pigs and those to be finished in seven to nine months must necessarily have grain in addition to pasture to reach the weight demanded by the market. In the absence of grain, pigs and shotes on pasture may become stunted and the cost to finish them thereby increased. Rapid gains come early in life. When the fattening period is reached, grain should be given freely, if the pigs are to be fully finished.

Frequently mature breeding stock may be kept on good pasture alone when no gain is expected. Hogs that are nearly grown may be kept on good pasture without other feed and make slight gains.

The place of forage crops in economical pork production is established. "As a result of three years' work in Iowa, it was found that the best dry lot gain cost with 50-cent corn, $4.36 per hundred as compared with $2.88 on alfalfa pasture, $3.69–$3.84 on red clover, and $3.63–$3.95 on rape. The gains were also less rapid in the dry lot than on pasture." In a Kansas trial, the lot receiving ground corn in a dry lot made only one-third the gain made by those receiving ground corn on alfalfa pasture, and consumed twice as much grain to produce a pound of gain.

A succession of forage crops to keep pigs growing is a matter of first importance. The usual order in which the crops will become available with the rate of seeding and the time of sowing is given in table 3.

TABLE 3. Forage Crops for Swine

Crops	Time of sowing	Amount of seed to sow per acre	Period available
Rye	July to September	6– 8 pecks	Fall and following spring
Wheat	August 20	6– 8 pecks	Fall and following spring
Clover	Spring	10–15 pounds	Fall
Alfalfa	Spring or summer	20 pounds	Following season
Hairy vetch	March to April with oats, or fall with rye	10 pounds	Fall and following spring
Dwarf Essex rape	March to August	2– 5 pounds	Same season
Peas and oats	April 10–15	1½ bushels each	After June 15

FEEDING CONDITIONS

Contrary to popular belief, pigs are creatures of cleanly habits and in order to do well require as wholesome feed as other domestic animals. The consumption of filthy feed retards and impairs digestion, threatens health, and reduces the gain. All arrangements for feeding should recognize these facts. Nature's methods are best with such slight changes as necessary control and housing impose. The pig's feed should not be allowed to become contaminated with his own excrement. When the pigs are on green forage, this is a simple matter to prevent; but when they are confined in muddy yards or pens, this is difficult. Therefore proper troughs and a feeding floor or a self-feeder are necessary to best results and will return their cost in a single year thru better gains.

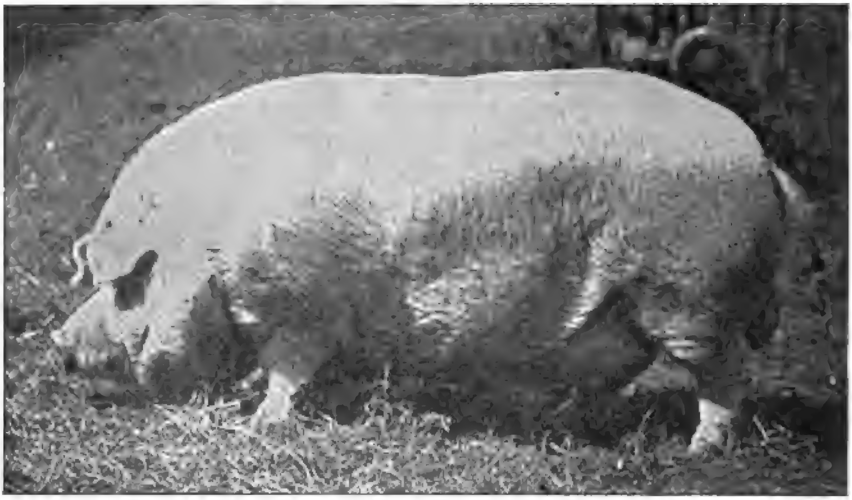


FIG. 4. CHESTER WHITE BOAR

GRAIN RATIONS FOR PIGS

The digestive system of the pig is relatively small. He lacks capacity for roughage when compared with the horse, the ox, or the sheep, but within his capacity coarse foods serve well to strengthen and develop his powers of consumption. Because of the nature and capacity of the digestive apparatus of the pig, he requires food that is concentrated and digestible, especially at the time of finishing. Small pigs cannot use to advantage large amounts of crude fiber. Their ration should be concentrated and digestible with a reasonable amount of bulk.

In the pork-producing regions of the United States, corn is the most common grain used to fatten hogs. Corn is low, however, in protein,

rich in carbohydrates and fats, but deficient in mineral matter. Experience has shown that corn alone is not the most economical feed for fattening pigs. It needs to be supplemented with feeds richer in protein and particularly in lime. It is therefore customary to combine corn with middlings, tankage, or skimmilk in proportions to insure continual development of the animals as to both growth and fattening. Corn alone will not give so large gains as when properly supplemented.

Corn may be fed as grain, or it may be " hogged down " by the animals in the field. As indicated earlier in this lesson, the New York farmer will probably be able to use corn to but a limited degree. Either the pigs will have to be finished on a substitute for corn, or they may be marketed before they are fully finished. A comparison of corn alone with corn and tankage and corn and buttermilk in the feeding of three different lots of pigs is given in table 4, compiled from results obtained by the Indiana Agricultural Experiment Station. Hogs on full feed of corn should gain about one pound per day and make about ten pounds of pork from a bushel of corn. If there is plenty of time for pigs to mature, it does not pay to grind corn. The inefficiency of corn or similar grains alone in putting gains on pigs is shown in table 4. The striking results when a small amount of tankage or buttermilk is used with the corn should be noted.

TABLE 4. COMPARISON OF CORN, TANKAGE, AND BUTTERMILK WHEN FED TO TEN PIGS IN A LOT FOR 70 DAYS*

	Corn alone	Corn and tankage	Corn and buttermilk
Average initial weight, pounds	79.00	79.50	78.50
Average final weight, pounds	99.00	173.50	206.50
Gain per pig, pounds	20.00	94.00	128.00
Pounds feed required per pound gain			
Corn	8.06	2.90	2.35
Tankage	....	.41	....
Buttermilk	....	....	6.94
Average daily gain, pounds	.29	1.34	1.83
Cost per 100 pounds gain	$8.64	$3.92	$4.08

* Cost of feed: corn, 56 cents per bushel; tankage, $50 per ton; buttermilk, 25 cents per 100 pounds.

Hominy feed is a fair substitute for cornmeal in the ration of fattening pigs. In a limited number of trials it required fourteen per cent less hominy feed than cornmeal for one hundred pounds of gain.

Barley is probably the next in importance of the carbonaceous feeds for swine. It is a highly esteemed feed for the production of bacon and should find a useful place among New York farmers in the ration for swine.

It is not palatable to swine and therefore should not be fed alone. It should always be ground or rolled and used with feeds rich in protein. In combination with middlings it lacks only about ten per cent in being equal to corn.

Wheat and wheat by-products in proper combinations are extremely valuable concentrates in the pig's ration. Whole wheat should be rolled or ground and is fully equal to corn in fattening pigs. Only under unusual economic conditions can one afford to feed wheat.

Coarse wheat bran is rather bulky, and it should not constitute more than ten per cent of the grain mixture. The use of the various grades of middlings and the low-grade flours is to be preferred. Wheat middlings are very popular as the nitrogenous supplement of pigs' rations. Ground limestone should be fed in conjunction with them to supply the deficiency in mineral matter. Experience has shown that the feeding of middlings alone is not most economical. They should be used with corn, tankage, skimmilk, and the like, to give best results.

Red-dog flour is an especially valuable feed for young pigs. It is highly palatable and digestible and has a low fiber content. In the pig's ration it produces generous gains.

Oats are a suitable feed for swine under certain conditions. For mature breeding stock and shotes, a limited amount of whole oats may be found useful. Usually oats should be ground for pigs. Ground oats are so bulky that they should not be fed alone to fattening pigs. They may constitute one-third of the grain ration during the early part of the feeding period, but toward the close they should be omitted. Oats and corn, and corn and skimmilk are good combinations, but oats and skimmilk is a poor combination.

In recent years, tankage has found an important place as a concentrated nitrogenous supplement in the finishing of fattening pigs. This is a meat meal well balanced in composition, with generous amounts of calcium and phosphorus. It is probably exceeded only by skimmilk and buttermilk in producing thrift and rapid gains. When high-grade tankage is used, that which has about fifty per cent of protein, not over ten per cent is needed to balance the ration. Less will suffice when animals have access to leguminous pasture or roughage. As pigs approach maturity, less tankage should be used. Rather young pigs may require as much as twenty per cent, tho part of this need may better be supplied with middlings and oilmeal. As with many other feeds, tankage gives best results when fed in conjunction with other concentrates, due to the beneficial effects following the use of proteids from a variety of sources. Tankage is a sterilized meat meal by-product that may be obtained from any agent of the large packing houses.

The oilmeals are worthy of mention tho their place in pig feeding is rather limited. For brood sows a small amount of linseed meal serves as a laxative. Large amounts required to balance a ration of corn may prove unpalatable to pigs. As a supplement to corn, oilmeal is slightly better than middlings and about one-half as good as tankage.

Cottonseed meal, except in very small amounts and for periods under forty days, is likely to prove fatal to pigs. The risks incident to its use are too great to justify placing it in the ration.

Cull peas and beans are frequently available on New York farms. These may be profitably used if fed with suitable carbonaceous grains. Either one fed alone will not give the best returns. Cull table beans are valuable for hogs when well cooked and given in connection with some starchy food. For growing pigs a mixture of two parts beans, two parts wheat middlings, and three parts cornmeal has been found satisfactory. The cost of cooking will need to be considered.

Rye alone is not an especially desirable hog feed, particularly for fattening. It should be ground or rolled and supplemented with a nitrogenous feed, such as tankage, middlings, or oilmeal. Rye meal ranks below corn but about equal to barley. Pork from rye in combination with other feeds is of satisfactory quality.

Some appropriate grains mixtures for swine under different conditions are indicated as follows:

WINTERING BROOD SOWS

6 cornmeal	6 cornmeal
3 middlings	4 middlings
1 tankage	skimmilk

SOW WITH PIGS

4 cornmeal	5 cornmeal
5 middlings	5 middlings
1 tankage	skimmilk

Young pigs after weaning should be fed chiefly skimmilk and middlings. Corn should be added slowly until the fattening ration is reached.

FATTENING PIGS

7 cornmeal	7 cornmeal
2 middlings	3 middlings
1 tankage	skimmilk

TABLE 5. FEEDING STANDARDS FOR SWINE

	Per day per 1000 pounds live weight			Nutritive ratio
	Dry matter (pounds)	Digestible protein (pounds)	Total digestible nutrients (pounds)	
Fattening pigs (weight in pounds)				
30– 50	46.2–51.0	7.8–8.5	41.0–45.4	4.0–4.5
50–100	37.0–40.8	5.5–6.0	32.9–36.4	5.0–5.6
100–150	32.4–35.8	4.4–4.9	28.9–31.9	5.5–6.2
150–200	29.0–32.0	3.5–3.9	25.8–28.5	6.2–7.0
200–250	25.5–28.1	3.0–3.4	22.7–25.0	6.5–7.3
250–300	22.4–24.8	2.6–2.9	20.0–22.0	6.7–7.5
Brood sows with pigs	20.0–24.0	2.4–2.7	18.0–21.0	6.0–7.0

FREE-CHOICE SYSTEM OF SWINE FEEDING

No discussion of the feeding of pigs would now be complete without reference to the free-choice system. Many feel that this system, which

FIG. 5. FREE-CHOICE FEEDER, SIDE VIEW

is rapidly gaining ground in other States, marks a new epoch in the feeding of hogs for market purposes. Whether it should be generally adopted in New York, where grain feeding must necessarily be limited, remains to be determined. The principles involved in such a plan are not new, but they are worthy of study now as a means of avoiding labor.

FIG. 6. FREE-CHOICE FEEDER, END VIEW

The animal with an unperverted appetite has instinctive ability, if given the opportunity, to select his feeds in such amounts and proportions as to supply himself with essentially a balanced ration. The plan is almost too simple for definition. The pigs have an opportunity of feeding themselves at any time or all the time. They mix their own feed and are responsible for the balance of their own rations. "A self-feeder for shelled corn, concentrates, and condimental or mineral food, in separate compartments is placed in the dry lot or small enclosure, which may also contain green rape, alfalfa, bluegrass, or timothy, and whenever the tenants crave any of the materials or any combination of them they are free to make their own choice, and to eat as little or as much as they want." Many comparisons between free-choice and hand feeding on the basis of cost of gain, rapidity, amount of gain, and profit are in favor of the former. It is essentially a system for fattening in a dry lot at a stage when the appetite of the pig may be depended on to guide him safely.

There is serious question as to the value of such a system for the rearing of breeding stock. The development of proper size and bone and the prevention of overfatness call for more control than a breeder would care to entrust to a free-choice system. It could be used in part, however, with good results in conjunction with green forage crops. Bone-building concentrates should be provided and change made to hand feeding before the pigs become too fat.

Self-feeders may be constructed by any farmer who wishes to try the plan, at an expense of from $6 to $10. There are various patented automatic feeders on the market, but the homemade kind will give as large net returns.

One feeder with experience says: "In one compartment put corn or ground barley, in another middlings, in a third a half and half mixture of tankage and linseed oilmeal, and in a fourth the mineral or condimental mixture as follows: one bushel wood ashes, one bushel ground charcoal, ten pounds common salt, five pounds sulphur, two pounds copperas and one pound ground limestone." He states that he has found that tankage is the most economical protein concentrate with which to balance barley or corn but that the addition of middlings and oilmeal to the ration gives slightly increased gains.

POINTS ON BREEDING

This lesson is not designed to cover at all completely the subject of swine breeding, further than to indicate the type in demand and how to obtain it. Generally speaking, there are two types of hogs, the lard type and the bacon type. The former is more universal, the latter being adapted only to special conditions of production and marketing. As the bacon breeds are less common and do not generally bring a premium on the market, farmers in this State naturally turn to the lard type for early maturity, desired conformation, and weight at an early age. An active type of hog must be selected to make full use of pastures and forage crops.

The breeds of the lard type that meet these requirements are Poland-China, Berkshire, Duroc-Jersey, Hampshire, and Chester White. Among the breeds of the bacon type are the Yorkshire and the Tamworth. The Hampshire and the Cheshire are sometimes classified as of bacon type. They are good grazers and for this special purpose mature as quickly as other breeds.

Utility must not be overlooked; hence one should question himself closely as to why he is breeding the animals he has chosen. Success lies in producing the type of market hog in demand. This has been interpreted to mean the animal that will give the largest proportion of valuable

meat, make rapid and cheap gains, and that will reproduce in profitable numbers. The requirements of both the feeder and the butcher must be considered. While a few breeders will readily turn their attention to pedigreed or registered hogs, the mass of farmers intent on utility stock are likely to feel satisfied with grades or crossbreds. The high fecundity and rapid succession of litters with sows are strong arguments for breeding nothing but purely bred swine. In the slower-breeding sorts of domestic animals a deliberate process of grading-up is probably to be recommended. With swine, there is small excuse to avoid purely bred stock, for the

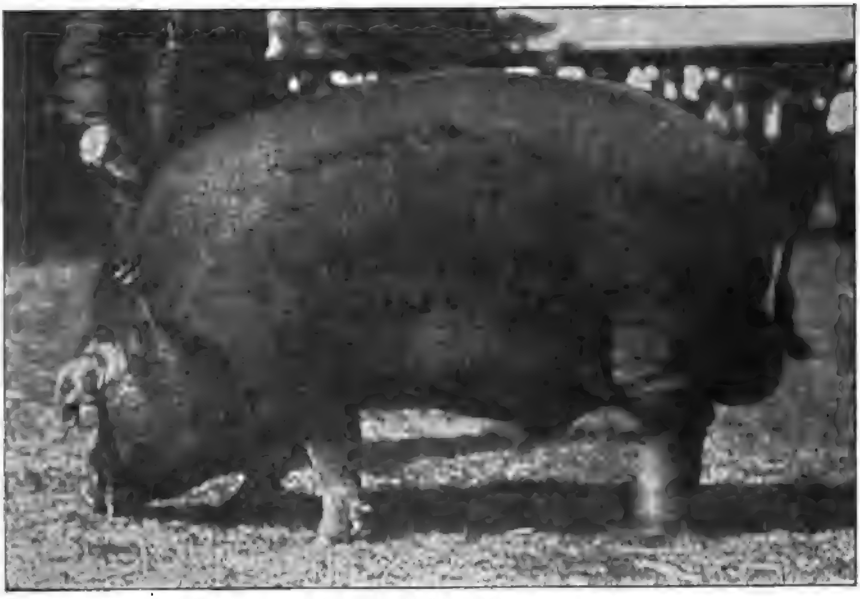


FIG. 7. DUROC-JERSEY BOAR

rapidity of increase soon reduces the initial cost to a small amount per animal. Animals of high utility spring from matings of types that meet the market need. Mating of extreme types should be avoided. Roomy, growthy females that are not coarse, should be used, for they are likely to be good and prolific mothers.

THE BOAR

Too much care cannot be given to the selection of the boar. Purebred males are now plentiful, and in view of their superiority their use should be universal. The use of a grade boar should not be permitted under any circumstances, as a purebred transmits his superior qualities with greater certainty and more uniformity.

Price should not be the first consideration in selecting a boar. Extreme investments are not necessary, tho a good sire is worth a substantial price. This is due to the fact that he is able to put superior growth and fattening qualities into his offspring. No person can get far in the swine business who fails to realize the value of such qualities and who is not willing to pay for them. The extra cost of a good boar as distinguished from that of a common one soon disappears when distributed to the whole pig crop.

In addition to price, judgment and experience should have full weight in selecting the boar. The old and tried boar should not be overlooked. Like aged sires in other classes of stock, they are sometimes unjustly discriminated against.

The first requirement of the boar is health and evidences of constitutional vigor. Having made sure of the general type of fat hog or bacon hog as the case may be and the breed characteristics to which he belongs, the next things to look for are bold carriage and masculinity. Coarseness and roughness are not desirable, but they are less objectionable than a lack of masculine qualities.

SELECTION AND CARE OF THE SOW

Often the hogs kept by farmers in New York State are of nondescript breeding and of inferior type. The number of breeders of purebred swine is increasing, as is the percentage of hogs with better blood, tho the actual progress made is not so rapid as it should be. The use of high-class boars on sows of approved type should be vigorously practiced. In so far as possible the sows retained for mothers should be carefully selected to hasten the fixation of the more desirable traits of type, quick maturity, and fecundity.

The sow should be short, blocky, and yet refined, and should possess size without coarseness. Her mammary development should afford twelve active teats. She should be strong in the feet, the back, and the legs, and should be able to carry herself well at all times. The profitable sow must be a good mother, produce large litters of uniformly good-sized pigs, and have a plentiful supply of milk for their early nourishment. If she is properly started when the pigs arrive, much anxiety and loss may be avoided.

It is important that the sow should have every attention at farrowing time, as it is worth all the effort it takes. The difference between an average of two or six to eight pigs to the litter is often made by giving intelligent attention when needed. The cost of each pig at birth is exorbitant if the sow raises only twins; it is three times as great as if a half dozen were raised. Profits or losses in the hog business are fre-

quently determined at this time. The task of raising pigs loses its interest when there is certain knowledge that the initial cost is so high as to eliminate all chance of profit.

A week or so before the sow is due to farrow, she should be removed from the other hogs and given quarters by herself. She should have a laxative ration tho not in too generous amounts. A good grain mixture for this time is composed as follows: 40 per cent corn, 35 per cent middlings, 15 per cent bran, and 10 per cent oilmeal, by weight. As the farrowing date approaches, the ration should be reduced somewhat. The need for cooling laxative foods is imperative at this period.

The pen for a farrowing sow should not have too much bedding. A bushel of chaff or cut straw, if the place is dry, will be sufficient and less dangerous to the pigs than large amounts of bedding. The sow should not be disturbed unless assistance is needed; if aid is necessary, it should be rendered in the most quiet manner possible.

Newly born pigs should not be allowed to become chilled before they are dry. If the sow is gentle, the pigs should be taken away as fast as they are farrowed if the weather is cold, and placed in a box or a barrel with hot bricks and blankets or other artificial heat. When the pigs become lively and dry, they may be returned to the sow. If the pigs are badly chilled, they may be revived by immersing them in hot water.

The sow's milk flow should not be stimulated for a few days. She should be fed very lightly, and given warm water if the weather is cold. It is not necessary to feed her for a day or two, and the first feed should be a thin slop. Her feed should be gradually increased as the pigs develop, until in two weeks' time she should be on full feed, consisting of a good laxative milk-producing ration. The best gains on pigs are made thru the mother, and she should be fed accordingly.

Some sows raise many pigs; others raise few. The size of the litter depends mainly on the sow. After her first litter the performance of the sow should be carefully noted in making selection of those to be retained. The sow that milks freely and forces six or eight pigs along at a rapid pace, even tho she may be rather thin after two months of nursing, is the one to keep. Rigid selection on this basis, not ignoring form, will rapidly advance the swine business. Brood sows from small litters should not be kept. It is a simple matter to mark the sow pigs from desirable large litters to serve if needed as future mothers. Sows should be at least a year old before producing the first litter. Mature sows produce ten per cent more pigs and twenty per cent heavier pigs than those bred too young. Usually inbreeding and immature boars should be avoided.

The period of gestation in sows is about 112 days. They vary somewhat in this particular, young sows being likely to farrow a few days sooner, while old sows frequently go a few days over this period.

The age of first breeding the sow is important. Most good breeders prefer not to breed the sow before she is eight to twelve months old. In all livestock, too early breeding is likely to reduce size. A very young sow is seldom able to raise a fair-sized litter and properly continue her own development. Another objection is that a small litter fails to properly develop the mammary glands, so that she rarely makes a good nurse with subsequent litters. An underdeveloped sow will not retain her usefulness over a long period, nor are her pigs likely to be strong and vigorous.

After the pigs are weaned, a mature sow may be bred again if not too much reduced by nursing. If she is thin and emaciated, immediate breeding will result in a small litter. Young sows with their first litters should usually not be bred to farrow again the same year. The breeding sow need not be fat, but should have three or four weeks of liberal feeding in order to insure a normal litter of large, vigorous pigs. With great care two litters may be produced each year, provided the animal does not have to be fitted for show. The sow's feed should be reduced when the pigs are being weaned.

CASTRATION

Boar pigs not intended for breeding purposes should be castrated before weaning. With care, however, it may be done later. The best time is when the pig is from four to six weeks of age. If the operation is performed at this time, the pig is still easily handled and the consequences are not serious.

The pigs to be castrated should be put into a clean pen to facilitate catching and to lessen excitement. There should be another clean pen to receive them after the operation. Dust, dirty litter, or mudholes should be avoided. A sharp knife is essential, and a three-per-cent solution of standard disinfectant is recommended. The knife, the hands of the operator, and also the parts of the pig concerned, should be washed with the disinfectant before the incision is made. Some breeders recommend an application of pine tar in hot weather to keep flies and insects from the wound. Accidents in such cases are rare, but care is always desirable.

THE YOUNG PIG AFTER WEANING

Opinions differ as to the best age at which to wean pigs. Weaning at six weeks is seldom advisable unless the pigs are well grown and are accustomed to their new feed. If the pigs are left on the sow too long, two litters cannot be had the same year. If still thriving, they should be left on the sow as long as circumstances permit.

Nothing equals skimmilk and middlings for young pigs after weaning. Soaking or scalding middlings may tend to prevent digestive troubles

and makes it better relished in the absence of skimmilk. Young pigs should be fed four times a day at first, and later three times.

Day says:[2]

. . . . . . When pigs are about three months old, a little corn or other grain may be introduced into their ration. Two parts of middlings and one part of corn meal or ground barley, mixed with skim-milk to form a slop, make an excellent ration for growing pigs. As the pigs grow older the proportion of grain to middlings may be increased, but at no time should they be fed exclusively or almost exclusively upon corn, because corn is a poor bone- and muscle-former. . . . . .

The aim should be to develop bone and muscle during the early stages of growth, and, while the pigs should be thrifty and sleek in the hair, they should not be fed in such a way as to overload them with fat. This is especially true of pigs which are intended for breeding purposes, and which should be carried right through to breeding age upon feeds which stimulate growth and general vigor rather than fat. . . . . Variety in feeds and plenty of exercise are very essential features in raising an animal that will possess all-round development.

FIG. 8. DUROC-JERSEY SOW

HOUSING

A complete discussion of housing swine is not possible in this lesson. Conditions vary on farms, and the piggery in any case must be adapted to the needs. Any system of housing calls for light, ventilation, dryness, reasonable warmth, and convenience of arrangement. There are two general systems of housing swine, the colony system and the centralized piggery. If the number of sows to be kept is small, the colony system is adequate. If the business is extensive, some prefer the centralized plan.

In the colony plan the houses are inexpensive and of the shed roof or A type. They are about eight feet square on the ground and will

[2] Productive swine husbandry. G. E. Day.

accommodate a sow and litter until weaning, when they may be used to house the litter. In winter they may be used for a number of brood sows if properly bedded and well protected. The advantages of this plan are cheapness, sanitation, and facilities for exercise. Being portable, the houses may be shifted about to suit convenience. The disadvantages lie in increased labor in caring for the animals, extra labor in feeding, and general temptation to neglect the work.

The centralized piggery system is common on the larger farms, especially on breeding establishments, where two litters of pigs are expected each year. It is more permanent than the colony system and provides means for the best care thruout the year. The animals are all housed under one roof with pens facing on outside yards. This system has the advantage of ease in doing the work and encourages care in every way. The obvious disadvantages of the centralized house on the average farm are the large investment, the danger of extending disease, the difficulty of compelling exercise, and the lack of adaptation to pasturing conditions.

The average farmer wants a system of housing that is first inexpensive and with all adapted to a pasture and forage plan of feeding. Therefore some plan of colony-house arrangement is best for the larger part of the year. In regions of extreme cold a permanent warm enclosure for brood sows is recommended.

HEALTH

The hog is both susceptible to disease and difficult to treat when once attacked. Undue confinement and filthy conditions soon break down his resistance, and disease once established sweeps thru the herd with alarming rapidity. Dry, clean sleeping quarters, tight floors, and adequate drainage are essential to success with swine. Pens should be cleaned frequently, portable houses moved at intervals, and systematic disinfection practiced.

At least once a year the pig houses and pens should have a good cleaning. All bedding and manure should be removed, all walls and floors sprayed or washed with a standard disinfectant solution. A mixture of 5 parts of carbolic acid to 100 parts of water is recommended. Five or six ounces of chloride of lime to a gallon of water makes an effective disinfectant. A pint of carbolic acid with three gallons of whitewash applied to the walls and other parts of the houses, will do much to improve appearances and insure health.

In case of a serious outbreak of disease a quarantine should be established, and the case brought to the attention of a competent veterinarian. The losses in this country from hog cholera and allied diseases are too great to justify halfway measures.

Hogs are likely to be lousy, especially if housed. Lice are a drain on the hog's vitality and should be destroyed. Dipping, spraying, and

washing with a two-per-cent solution of a good dip will prove effective. With a small number of animals, washing or spraying may serve the purpose; but if a considerable number are to be treated for lice, they should be put thru a dipping vat. Dipping all over is the most effective treatment. The tank should contain lukewarm water to which the disinfectant dip has been added. The pig should work his way thru the tank with his nose out. A second treatment about a week after the first one should be given. This latter application reaches the lice not previously hatched and ensures a clean, comfortable animal ready to respond in the largest measure to feed and good care.

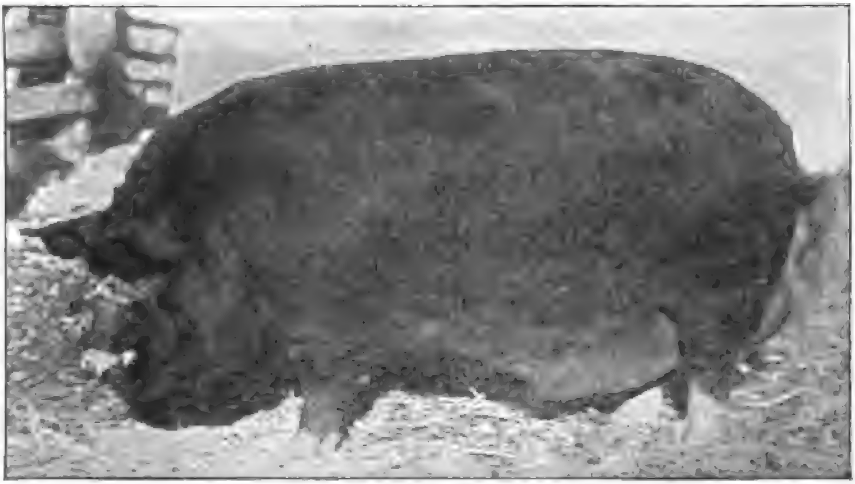


FIG. 9. BERKSHIRE BOAR

A PLAN FOR HOG RAISING

The best interests of hog raising in the East will be served by a plan that thru the minimum use of concentrates ensures cheap and rapid gains with the least labor. Pigs develop rapidly on natural forage crops if the needed nitrogenous supplements and the opportunity for activity are provided. It has been shown that the feeding of corn or any one concentrate alone is not profitable. There should be balance, variety, and the like, for quick gains. "The three elements in the ration of a growing pig that are more important than all others are protein, succulence, and exercise." After a certain weight is attained, additional gains are obtained at greater cost per pound. It is therefore probably not advisable to try to produce a greater weight than two hundred to two hundred and twenty-five pounds.

It cannot be emphasized too strongly that the cost of pork is reduced materially by the use of pasture and forage crops. To these crops for young and growing pigs and for finishing, some grain should be added. Hog raisers vary widely in the amount of grain fed, which naturally should vary according to the quality of forage available. The amount of grain used is determined largely by its cost. Some feed a ration equal to two to three per cent of the live weight of the pig, while others do not exceed a one-per-cent allowance.

Forage and pasture crops have a variable composition. Alfalfa, clover, vetch, and peas furnish feed richer in protein than most other crops. On such crops, pigs require less concentrates than when grazing non-leguminous pasture, such as timothy, bluegrass, or orchard grass. In early stages of growth the cereals are highly valuable. A plan that will provide in succession all the benefits of these crops thruout the growing season, should be worked out on every farm where pigs in any number are to be fed. Some of the advantages in "hogging off" crops are: (1) the cost of harvesting and marketing is reduced; (2) the labor of care is greatly reduced; (3) vegetable matter is added to the soil; (4) manure is distributed evenly and cheaply; (5) hogs get needed exercise. Pigs on pasture should be ringed and not allowed the run of too large an area at a time.

Crops are "hogged down" in two general ways: (1) by subdividing the area with movable fences into small divisions that will last the pigs ten to twenty days; (2) by turning the pigs directly into the whole field when the crop is ready. The former admits of greater control, tho the latter is more generally practiced. The number of hogs that can be pastured per acre depends on the richness of the soil, the season, the management of the hogs, the size of the hogs, and the kind and quality of other feeds used. The leguminous crops and rape will during their period of growth support eight to fifteen hogs per acre, the cereals and the grasses nine to twelve hogs per acre.

The following plan is offered as a rough suggestion covering the principles involved in obtaining a succession of forage crops. Five adjoining fields should be fenced making them any size — one acre or larger — depending on the number of hogs to be raised. Field 1 should be planted to alfalfa or clover, or clover and vetch. Field 2 should be seeded to rye the fall previous for early spring feed. Field 3 should be plowed early and planted to peas and oats. As soon as the ground is fit, field 4 should be seeded to rape, and later field 5 should be planted to flint or sweet corn, with rape or rye added at the last cultivation. Late in the summer, field 3 may be seeded to rye and in the following spring to clover to succeed field 2, and field 4 should be planted the spring following to peas and oats. Field 5 may be used for rape in the succeeding year.

A satisfactory hog pasture may be prepared by sowing together oats, peas, and sweet clover, using about twenty pounds of the latter seed per acre. Lime should be applied if the soil is deficient in that respect, and the sweet clover seed should be scarified and inoculated. Pasture will be furnished in the early part of the season by the oats and the peas and in the latter part by the sweet clover. The sweet clover will live thru the winter and furnish much feed the following summer. This plan suggests a seasonal succession of forage crops and indicates the general order of rotation.

A four-years rotation recommended is as follows: first year, rye seeded with sweet clover in the fall, and red clover and alsike clover in the spring; second year, clover pasture; third year, corn planted with soybeans, with rape sown at the last cultivation; fourth year, peas and oats or rape in successive plantings to be fed off with hurdles. A corn plot for finishing the pigs will be found an advantage.

Six to eight pounds of red clover, and eight to twenty pounds of sweet clover should be used to the acre. Rape or flat turnips may easily be sown in corn at the last cultivation, for grazing during the fall. In such cases two to four pounds of seed per acre will suffice.

CORNELL STUDY CLUBS

In a number of communities, groups have organized for the discussion and study of common problems, and have adopted the name of Cornell Study Clubs because of the use that they make of the Cornell reading course lessons to provide material for educational programs. Often a helpful reading course lesson will reach a farm home at a time when it cannot be given attention, and it is set aside and possibly forgotten. If, however, a special time is reserved for the study of reading course lessons at a club, it is likely that much helpful reading will be accomplished. It is a pleasure to discuss with others the common problems of work on the farm and in the home, and social as well as educational advantages should result from meeting together. The membership of Cornell study clubs may be composed of farm men and farm women, and separate discussions on agriculture and home problems may be held in different rooms of a common meeting place. Usually the men and women hold the opening numbers of the program together, and join in a social hour after the group discussions. If preferred, separate clubs of men and women may be formed.

While the primary purpose of a Cornell study club is to furnish an occasion and an incentive for reading and discussing reading course lessons for the farm and for the farm home, the objects of a Cornell study club may broaden to include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. As an illustration of ways in which Cornell study clubs may be of service to the community, information is given below on work that has been reported by Cornell study clubs. Last year one club arranged for the purchase of lime in carload lots, was instrumental in bringing purebred stock into the community, and its members worked together in filling an ice house for their common use. This year the club discussed the use of improved coal-burning brooders at its meetings, and members of the club obtained quotations and made up an order for twelve brooders, which were sold in the community. Correspondence from another club reads as follows: "We are planning a large meeting some time in June, and to invite outsiders to see what we are doing. We want to get some speakers for the occasion, if possible." The Supervisor of the Reading Course for the Farm attended the meeting, and found that the Chamber of Commerce of a neighboring city had been invited in order to promote good feeling between country and town. Other clubs have reported the cooperative purchase of lime, fertilizers, and flour for the benefit of members. Some clubs have used a sale and exchange list to promote local buying and selling. Others have held picnics, and made visits to the College of Agriculture.

The organization can be effected even if at first only half a dozen persons desire to start a club. The president and the secretary should be elected, a list of charter members made, and the dates and places for meetings determined. Some of the larger clubs may need a treasurer, a program committee, and a constitution and by-laws. The meetings should be held frequently enough to maintain an active interest in them; regularly every two weeks during the fall and winter is usually considered sufficiently often. If it is not advisable to meet every fortnight in spring and summer, monthly meetings are suggested. Study clubs hold their meetings in homes, different members entertaining in turn, in churches, and in schoolhouses. The meetings should proceed under a definite order of business to provide for a roll call, reports of committees or of delegates, unfinished and new business.

The program should be carefully planned at least several weeks in advance. Some of the clubs prepare printed programs of all of the meetings for the year. The opening numbers of the program may include readings, recitations, and music, in addition to the transaction of business. The group discussions should be in charge of a leader selected well in advance. After the group discussions, the clubs usually enjoy singing and games, and often refreshments are added. The reading course lessons should be obtained by the secretary of the group and distributed one meeting in advance so that the members may be prepared to take part in a general discussion to follow the leader's talk or reading. A question box is a useful addition to the program. Questions may be answered from local experience, or referred to the College of Agriculture. At the meetings of some clubs lists of articles for sale or for exchange are read, together with lists of articles wanted. By promoting local exchanges and sales of farm products, implements, stock, and the like, and by collective buying and selling, it may be found possible for the club to serve the business interests of the community.

The success of a Cornell study club depends principally on the development of local leadership. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College. Further information concerning organization, objects to be attained, and the preparation of programs will be sent on application to the Supervisor of the Reading Course for the Farm, College of Agriculture, Ithaca, New York.

Cornell Reading Course For the Farm

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK

A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 126 JULY, 1917 LIVESTOCK SERIES

SWINE PRODUCTION IN NEW YORK

DISCUSSION PAPER

The discussion paper takes the place of the teacher in encouraging thought and self-expression on important points in the lesson, and in giving an opportunity for questions by the reader. Each discussion paper filled out and returned is read carefully, and a personal reply is made to questions on any agricultural subject. In order to continue a course, the reader should sign and return the discussion paper so that another lesson may be sent. Questions are included on the discussion paper for the purpose of assisting those readers who desire to give the lesson special study. The preparation of answers is optional.

The available reading course lessons for the farm are arranged in series on the following subjects: THE SOIL, FARM CROPS, LIVESTOCK, DAIRYING, FARM FORESTRY, FRUIT GROWING, PLANT BREEDING, THE HORSE, POULTRY, VEGETABLE GARDENING, FLOWER GROWING, COUNTRY LIFE. New readers may enroll in one or more of these subjects. The first lesson in the series is sent on enrollment, and subsequent lessons are sent, one at a time, on the return of discussion papers. The reader may register for the Livestock Series by signing and returning this discussion paper. The space below on this page is reserved for registration in other series, and also for names and addresses of residents of New York State likely to become interested in the reading course.

(Detach, sign, and return for the next lesson in this series.)

(In answering questions, attach additional paper if needed and number the answers.)

1. What are the conditions in New York State that make it possible to produce a limited amount of pork profitably?

2. What economic conditions make it difficult for a New York farmer to compete with a farmer in the Corn Belt in pork production?

3. What is your most valuable by-product used in pig feeding? What value do you attach to skimmilk or buttermilk when fed to growing pigs?

4. Have you ever had experience in feeding garbage or similar refuse to pigs? What results were obtained?

5. How many pigs do you fatten each year? Do you keep brood sows? Under what conditions should a farmer buy his pigs or raise them?

6. How do you handle your pigs in summer? Which is more desirable close yarding and grain feeding, or free range and forage crops? Give your experience.

7. Outline a satisfactory succession of green forage crops for swine, preferably from experience or observation.

8. What are the advantages of the colony plan of housing? the disadvantages?

9. What are the advantages of the centralized piggery? the disadvantages?

10. Have you had experience with the free-choice system of swine feeding? If so, give your opinion of its value.

11. Criticise the plan for hog raising on page 27 with reference to its application in your case.

12. Do you endeavor to produce your home supply of meat? What proportion is pork?

Name. . . . .

Address. . . . .

Date. . . . .

(Address all correspondence to the Reading Course for the Farm, College of Agriculture, Ithaca, New York.)

THE CORNELL READING COURSE FOR THE FARM

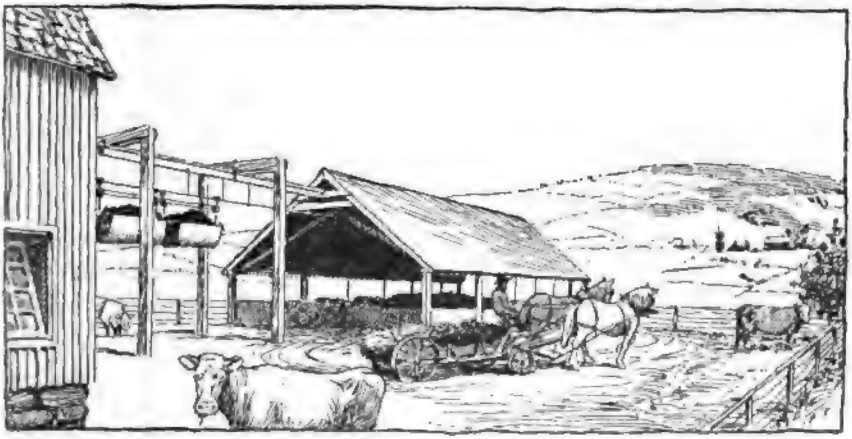
PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 127 | THE SOIL SERIES | AUGUST, 1917

FARM MANURE

ITS PRODUCTION, CONSERVATION, AND USE

ELMER O. FIPPIN



A MODERN COVERED MANURE PIT

Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

THE CORNELL READING COURSE FOR THE FARM

" Upon the farmers of this country in large measure rests the fate of the war and of the nations."— PRESIDENT WILSON, April 15, 1917

Under war conditions the skillful work of the man on the land has become more important than ever before. There is indeed every reason for zeal in increasing food production. Knowledge will help to make labor productive. Abraham Lincoln once said, " No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought, as agriculture." The College of Agriculture, through the Reading Course for the Farm offers twelve series of lessons for home study free to residents of New York State. More information about these lessons is given on the attached discussion paper.

Three advanced reading courses, in farm crops, fruit growing, and vegetable gardening, provide instruction in accordance with modern correspondence methods, but without college credit or certificate. Each student provides himself with a textbook and materials for practical exercises. Reports are prepared which are corrected, graded, and returned with criticisms and suggestions.

In a number of communities groups have organized for the discussion and study of common problems, and have adopted the name Cornell Study Club. The primary purpose of a Cornell study club is to furnish an occasion and an incentive for discussing reading course lessons for the farm and for the farm home, but the objects include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. Cornell study clubs are educational and social centers, and should develop local leadership and the human resources of the community. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College.

Correspondence is a medium for the exchange of helpful information. Letters will receive careful attention.

ROYAL GILKEY,

Supervisor of the Cornell Reading Course for the Farm.

FARM MANURE: ITS PRODUCTION, CONSERVATION, AND USE

Elmer O. Fippin

The manure of farm animals is in the aggregate enormous in amount, and, when wisely used, is a most valuable contribution to soil improvement. In New York State the animals on farms produce approximately thirty million tons annually, which is sufficient, if it were all saved, to make an application of three and a half tons on every acre of tilled, grain, hay, and fruit crops in the State. Excluding the hay land, it is sufficient to provide six tons per acre for all the other crops. The gross value of this manure, conservatively estimated, is equal to the annual expenses of the State government. In addition, the animals in towns and cities produce four million tons annually.

The manure of animals is a valuable by-product of animal husbandry for the same reason that the abattoir products, when turned into commercial fertilizers, are valuable by-products of the meat-packing industry. Manure is valuable because it contains certain constituents that the animal has derived from its food. This lesson classifies these constituents and points out their effect on the soil, gives the proportion of each constituent returned in the manure as compared with the amount in the food consumed, states the amount, composition, and value of manure from various farm animals, and suggests methods of conserving and applying manure. All these topics are discussed from the viewpoint of the requirements of soils for the production of good crops.

CONSTITUENTS OF MANURE

There are three groups of constituents that make the manure of animals valuable in crop production: namely, (1) the plant nutrients — nitrogen, phosphorus, potassium, and some other elements; (2) the organic matter; (3) the organisms that carry on active processes of decay. Of the last division, very little can be said further than that these organisms serve as an inoculating culture in the soil and carry forward biological changes and processes of decay. The nature of these organisms is still very imperfectly understood and means are not available for their extensive control.

EFFECTS OF MANURE ON THE SOIL

The effects of manure on the productive capacity of the soil are as broad as the effects of its constituents. They illustrate a fact common in soil

management; namely, that a particular treatment seldom has a single effect but rather a group of effects, some perhaps more evident than others. In selecting a treatment one must therefore consider what effect is desired as well as the possibility of the treatment giving the desired effect. The effect of manure, like the effect of organic matter, may be discussed under three general heads: physical, chemical, biological.

PHYSICAL EFFECTS DUE TO ORGANIC MATTER

1. The humus produced increases the granular structure and improves the tilth of the soil.

2. The improved tilth affords better drainage and better aeration of the soil.

3. The humus and the improved tilth increase the available moisture capacity of the soil and enable crops to better withstand drought.

4. Roots of crops are better able to penetrate the heavier soils and obtain the moisture and the plant-food required.

5. The humus darkens the color of the soil and thereby tends to maintain a higher average temperature, which makes more active many important processes in the soil.

CHEMICAL EFFECTS

1. Manure supplies the soil with all the elements of plant nutrition, especially with nitrogen and potash in which manure is particularly rich. As a result of the changes to which the food of animals is subjected in the process of transformation into manure, all the constituents are made more available than in the original food or in ordinary forms of organic matter.

2. The surplus of basic soluble materials in manure — the ammonia and the ash materials — aids in maintaining the alkaline condition of the soil essential for most crops. Liquid manure in particular is rich in these alkaline constituents.

3. The organic materials, including many acid compounds produced during the process of decay, increase the availability of the plant nutrients in the soil.

4. It has been shown that plants can utilize directly some organic compounds, and it seems probable that those resulting from the partial decay of manure may to some extent be used directly by growing crops in this intermediate organized form, thereby conserving the energy of the sun and the growing processes of the plant. This may produce a more rapid growth of plants than is possible with mineral plant nutrients alone.

BIOLOGICAL EFFECTS

1. The processes of decay set in motion in the digestive tract of the animal break down the constituents of the food and thereby increase their availability in manure.

2. The flora of manure appears to have an important relation to the biological processes in the soil, including the decay of crop residues.

3. The organic matter of manure affords a source of energy for organisms in the soil that contribute to productiveness. Nitrogen fixation by free living forms of bacteria has been shown to be dependent on such a supply of organic matter.

ACTION OF ANIMALS ON FOOD CONSUMED

Because of these numerous effects of the constituents of manure — the organic matter and the mineral plant nutrients — it is important that their course from the food thru the animal and in the subsequent management of the manure be carefully traced. In this way the value of the manure in relation to the total value of those constituents in the food consumed may be determined and the largest practicable conservation of all those materials brought about.

The animal consumes food for two main purposes: (1) to supply fuel for heat and energy; (2) to build up the body tissues and manufacture a product, such as meat, milk, eggs, or wool. The organic material supplies heat and energy for the animal body as does coal for the boiler or gas for the lamp. All the organic matter in the food must be accounted for. If it does not appear in the manure, it must have been retained in the animal body and turned into animal products, such as milk, or dissipated in the form of heat and energy. Nearly all the organic matter of the food that is digested is permanently withheld from the manure and constitutes a net loss in so far as the fertility of the soil is concerned.

The animal products other than heat and energy, so far as the manurial value of the food is concerned, draw upon both the organic matter and the nutrients. The larger the production of milk, meat, or wool, the larger is the abstraction of the plant nutrients consumed, and the smaller is the return in the manure. Milk production involves a larger abstraction of plant nutrients than does meat or wool production. All these forms of loss fall on the digested part of the food. The undigested food is never a part of the body, tho it passes thru and is voided with some loss by decay in the process. The waste from the digested portion of the food that is used by the animal to develop heat and energy, that is, to maintain the body, is represented by the solid manure, feces, or dung.

PROPORTION OF ORGANIC MATTER AND PLANT NUTRIENTS IN MANURE

Organic matter is a valuable constituent of manure. It has been customary to value manure for its content of plant nutrients — nitrogen, phosphorus, and potassium — and to say very little about the organic matter. In this lesson the distribution of the organic matter as well as the plant nutrients, will be traced, since that material is quite as important in the system of soil fertility as are the plant nutrients.

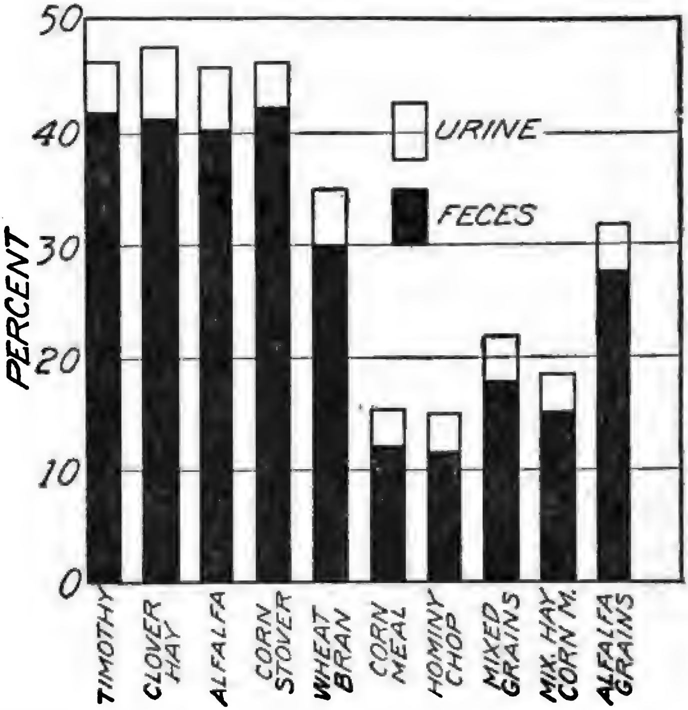


FIG. 10. PROPORTION OF THE ORGANIC MATTER IN DIFFERENT ANIMAL FOODS REGAINED IN THE MANURE OF THE STEER

Digestion experiments have been most often carried on with the steer and the sheep. The results with the steer are taken as the primary basis of the statements made in this lesson but are modified by available data on the digestive and assimilative processes in the cow. Dr. H. P. Armsby, of the Pennsylvania State College, has measured the digestibility of common feeds by steers in terms of energy units in the feed and in the waste products of the animal. He finds that about 50 per cent, or a little more, of coarse forage is digested, depending on its quality. This means that on the average less than 50 per cent of the organic matter

present in the food is returned in the manure. As a rule, the return is from 40 to 55 per cent for dry forage and gradually decreases for the less fibrous and more concentrated foods until for cornmeal and hominy it is only from 10 to 15 per cent. Energy is here regarded as synonymous with organic matter, or humus-making material. In other words, these concentrated foods are very efficient as fuel, but when fed to animals they are very inefficient as a means of returning organic matter to the soil. These facts are presented graphically in figure 10. A standard ration

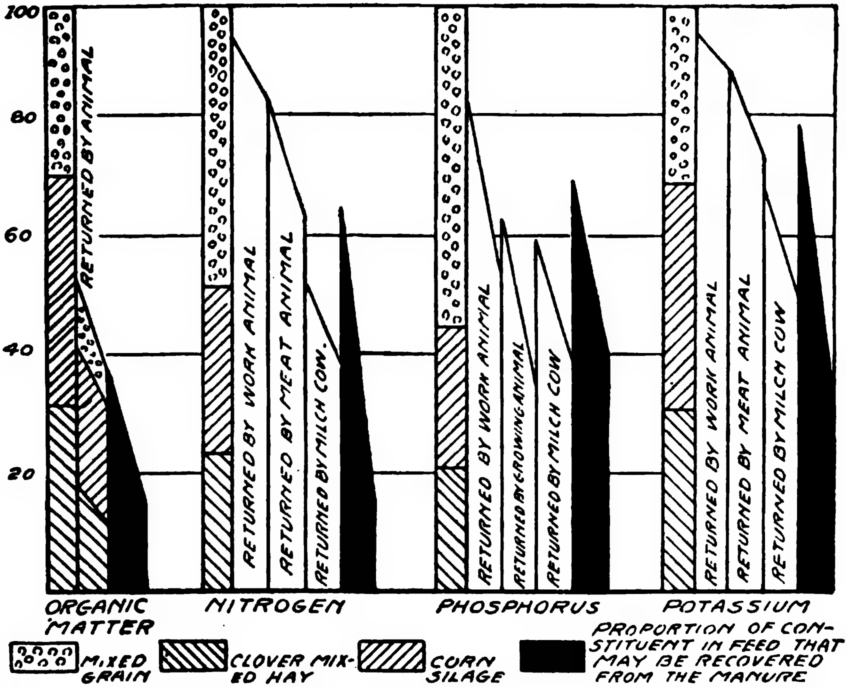


FIG. 11. PROPORTION OF CONSTITUENTS IN ANIMAL FOODS REGAINED IN THE MANURE

The blocks at the left of each group represent the distribution of one hundred pounds of the constituent among the several foods consumed. The middle blocks show the proportion of the constituent returned by the animal in the manure. The right-hand blocks show the proportion of one hundred pounds of the constituent in food that may be saved in the manure. The slope at the top of each block represents the range of variation

is a composite of feeds, and of these the animal returns from 30 to 45 per cent of the organic matter consumed. This is practically all found in the undigested part of the food. There is, it is true, from 4 to 6 per cent of the energy of the feed in the liquid manure, but that material is subject to rapid bacterial changes and is of questionable value. The undigested food, represented by the dung, undergoes an appreciable loss thru decomposition in the digestive tract of the animal. This is largely represented by the bowel gases, which use from 4 to 10 per cent of the food consumed.

This diversion from the soil and heavy loss of organic matter in the process of feeding animals should cause the farmer to hesitate if he is keeping stock primarily for the manure produced or if organic matter is the chief and controlling need of his soil, since other less wasteful methods may be employed. The practice of feeding animals must show a substantial profit on its own account if it is to be justified as a method of improving soil.

The plant nutrients are returned in both the liquid and the solid manure; therefore they follow a different course than the organic matter. A work animal that is not changing in weight returns nearly all of the plant nutrients consumed. A dairy cow that is producing a large flow of milk abstracts a correspondingly large part of the plant nutrients from her feed. This is a distinction between meat or work animals and dairy animals that has been neglected. The return of nitrogen is subject to the greatest variation by the animal, and the return of potassium to the least. A dairy cow giving a heavy flow of milk returns from 40 to 65 per cent of the nitrogen consumed, from 60 to 80 per cent of the phosphorus, and from 70 to 85 per cent of the potassium. A cow giving a small flow of milk returns a correspondingly larger amount of nitrogen, phosphorus, and potassium. An ox or a meat animal returns from 75 to 95 per cent of the nitrogen, from 65 to 85 per cent of the phosphorus, and from 90 to 98 per cent, or even more, of the potassium. Growing animals retain practically all the phosphorus in the digested part of the food. This means that in the undigested part of the food there remains less than half of the total amount of phosphorus consumed to find its way into the manure. These figures are summarized in table 1.

TABLE 1. LOSS OF CONSTITUENTS OF FOOD IN PROCESS OF DIGESTION SHOWN BY THE PROPORTION RETURNED IN THE MANURE

	Percentage
Organic matter	
Average dairy ration	45
Heavy concentrate ration	35
Coarse fibrous roughage ration	55 to 65
Nitrogen	
Dairy animals	35 to 75
Meat animals	65 to 90
Work animals	85 to 95
Phosphorus	
Young growing animals	35 to 50
Dairy animals	50 to 80
Work animals	75 to 95
Potassium	
Dairy animals	65 to 85
Meat animals	75 to 90
Work animals	90 to 98

In New York, where the dairy animal is such an important type of livestock, the heavy draft it makes on the organic matter and the plant nutrients in the food and the corresponding smaller return in the manure, as compared with that made by other types of animals, should be kept clearly in mind. The larger the milk production of the cow, the smaller is the proportion of the food returned in her manure. The approximate

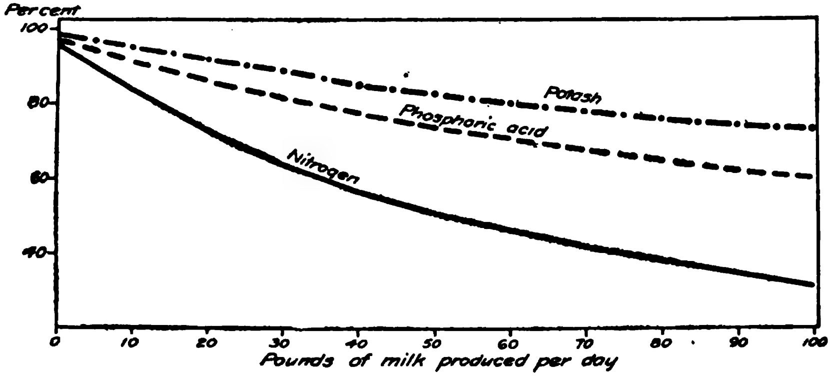


FIG. 12. APPROXIMATE PROPORTION OF PLANT NUTRIENTS IN FOOD RETURNED IN THE MANURE IN RELATION TO THE AMOUNT OF MILK PRODUCED

Milk is relatively richer in nitrogen than are the foods ordinarily consumed by milch cows. It corresponds approximately to the ratio 7 parts of nitrogen to 1 part of phosphoric acid to 2 parts of potash. A balanced ration corresponds approximately to the ratio 2.5 parts of nitrogen to 1 part of phosphoric acid to 2.2 parts of potash. Consequently there is less relative loss of the mineral plant nutrients than of nitrogen in feeding milch cows. This ratio is subject to much variation corresponding to the large variation in the composition of feeds

value of the manure of an animal may be calculated from the amount and composition of the food consumed, provided the proper discounts are kept in mind. The production and the composition of the manure in comparison with the food consumed are illustrated in the results of a study carried out on the Cornell University dairy herd (Table 2). The test was carried on for seven days on a herd of forty-six milch cows weighing an

TABLE 2. PRODUCTION OF MANURE BY THE CORNELL UNIVERSITY HERD PER THOUSAND POUNDS LIVE WEIGHT

	Daily amount	Annual amount
Clear excrement produced	75.5 pounds	13.75 tons
Excrement produced with bedding	85.7 pounds	15.60 tons
Organic matter consumed	21.1 pounds	7,700 pounds
Organic matter voided	9.18 pounds	3,350 pounds
Proportion of organic matter regained	43.3 per cent	....
Nitrogen consumed	0.585 pounds	215 pounds
Nitrogen voided	0.26 pound	94 pounds
Proportion of nitrogen regained	44.3 per cent	....
Proportion of ash regained	63.6 per cent	....
Proportion of water in manure	81.8 per cent	....

average of 1008 pounds each. They received a good ration of alfalfa hay, silage, roots, and mixed grain. All feeds were weighed and analyzed. The manure, which was collected on tight floors and in drops, was also analyzed.

The return in the manure of the organic matter in the food consumed was about equivalent to the undigested portion of the food. The proportion of the organic matter in the food consumed which was regained in the manure was about the same as the proportion of the nitrogen and twenty per cent less than the proportion of the plant nutrients regained in the manure.

AMOUNT AND COMPOSITION OF MANURE

The composition of both the liquid and the solid manure varies with the kind of food consumed and with the function of the animal. A young growing animal or an animal producing milk withholds more of its food than an animal producing meat or energy. A nitrogenous diet produces a manure rich in nitrogen. When a nitrogen-rich ration was fed to poultry, the proportion of all the constituents in the manure was found to be one-third more than when a carbonaceous ration was fed. A similar difference has been found when these two types of rations were fed to larger animals.

The relative production and composition of the liquid and the solid manure produced by one thousand pounds of live weight of the common farm animals is given in table 3.

The wide variation in the total amount of both liquid and solid manure produced by different animals, as shown in table 3, is due mostly to the amount of water introduced. The total annual production of manure, both liquid and solid, for one thousand pounds of live weight varies from five tons for poultry to fifteen tons for the pig. The total amount of dry matter and of the several plant nutrients does not differ widely for one thousand pounds of live weight of the different farm animals. The amount of dry matter in the manure is from two to two and one-fourth tons. In all animals except the horse the total return of nitrogen is largest in the urine. On the other hand the distribution of potash is irregular; the horse, the pig, and the sheep return the larger amount in the dung, while the cow returns the larger amount in the urine. Phosphorus is found only in very small amounts in the urine of all animals.

As a result of the different proportions of water in the manure of different animals, it has important characteristics that vitally affect its economical storage and its efficient use for certain purposes. The manure from the horse and the sheep is relatively dry and porous, undergoes rapid decomposition, and quickly develops a high temperature when stored in a large mass. The same action occurs in poultry manure, which has much the

TABLE 3. COMPOSITION AND VALUE OF THE MANURE OF FARM ANIMALS PER THOUSAND POUNDS OF LIVE WEIGHT

Animal	Constituent	Pounds produced per year	Water		Dry matter		Nitrogen		Phosphoric acid *		Potash †		Commercial value ‡			
			Percentage	Pounds	Percentage	Pounds	Percentage	Pounds	Percentage	Pounds	Percentage	Pounds	Plant nutrients	Organic matter	Total	Per ton
Horse	Urine	4,000	90	3,600	10	400	1.46	60	Trace	Trace	1.20	48	$11.50	$ .80	$12.30	$6.05
	Dung	14,500	70	10,150	30	4,350	0.45	66	0.30	44	0.40	58	14.60	8.70	23.30	3.10
	Total	18,500	74	13,750	26	4,750	0.72	126	0.27	50	0.57	106	26.10	9.50	35.60	3.85
Cow	Urine	8,000	93	7,440	7	560	0.80	64	Trace	Trace	1.00	80	$13.60	$1.10	$14.70	$3.65
	Dung	18,000	80	14,400	20	3,600	0.35	63	0.20	36	0.75	45	13.10	7.20	20.30	2.25
	Total	26,000	84	21,840	16	4,160	0.49	127	0.15	40	0.48	125	26.70	8.30	35.00	2.70
Pig	Urine	12,000	96	11,520	4	480	0.50	60	0.01	12	0.60	72	$13.10	$ .95	$14.05	$2.35
	Dung	18,000	78	14,040	22	3,960	0.30	54	0.25	45	0.30	54	12.60	7.90	20.50	2.25
	Total	30,000	85	25,560	15	4,440	0.38	114	0.19	57	0.42	126	25.70	8.85	34.55	2.30
Sheep	Urine	4,500	87	3,915	13	585	1.50	68	0.05	23	1.80	57	$14.00	$1.20	$15.20	$6.80
	Dung	8,500	55	4,675	45	3,825	0.80	68	0.40	34	0.50	43	13.75	7.65	21.40	5.00
	Total	13,000	66	8,590	34	4,410	1.05	136	0.44	57	0.77	100	27.75	8.85	36.60	5.65
Hen	Total	10,000	55	5,500	45	4,500	1.30	130	0.80	80	0.[illegible]	90	$27.20	$9.00	$36.20	$7.25

* In order to convert figures for phosphoric acid into terms of phosphorus, multiply by 0.4366.
† In order to convert figures for potash into terms of potassium, multiply by 0.832.
‡ Nitrogen is valued at 15 cents per pound, phosphoric acid at 4 cents per pound, potash at 5 cents per pound, and organic matter at 20 cents per one hundred pounds.

same characteristics. The hen voids its urine with the dung. On the other hand the large amount of water in the manure of the cow and the pig produces a dense, heavy, cold manure that does not heat and in a large mass does not undergo rapid decay. These characteristics will be referred to in discussing the preservation of manure.

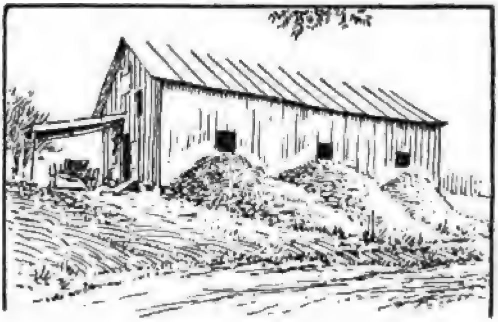


FIG. 13. WASTEFUL STORAGE OF MANURE
The result of such practice is shown in figure 14

VALUE OF MANURE

The annual value of the manure of different farm animals per thousand pounds of live weight and per ton is given in table 3. In every case, at the scheduled price of the organic matter and the plant nutrients, the urine is more valuable per ton than the dung. The value per ton of both urine and dung increases regularly with the proportion of dry matter. When all the urine and dung are saved together, the value of the mixed material per ton ranges from $2.30 for the pig to $5.65 for the sheep and $7.25 for the hen. The manure of all these animals, especially of the horse, the sheep, and the hen, is generally handled in a drier form than when freshly voided, that of the sheep and the hen frequently in the air-dried form. Such material has a correspondingly higher value in proportion to the water removed, and poultry and sheep manure may be worth as much as fourteen dollars per ton at the schedule of prices used. The annual value of the manure of animals per thousand pounds of live weight ranges from twelve to fifteen dollars for the urine and from twenty to twenty-three dollars for the dung, that is, the value of the dung is about twice as much as that of the urine. The total annual value of both urine and dung produced by a thousand pounds of live weight is surprisingly uniform and averages about thirty-six dollars at the prices used in these calculations. There is of course some question

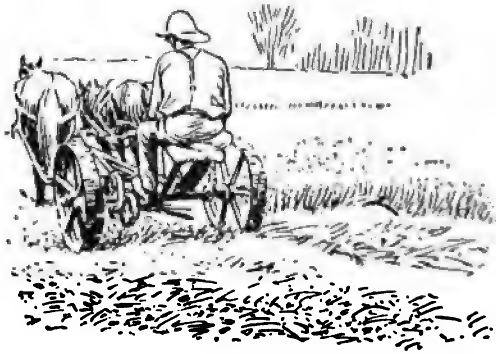


FIG. 14. CONSEQUENCE OF WASTING MANURE
The hay crop does not derive much benefit from leached manure

as to whether such high values should be placed on the constituents. These prices, namely, fifteen cents per pound for nitrogen, four cents per pound for phosphoric acid, five cents per pound for potash, and twenty cents per one hundred pounds for organic matter, are a little below the prices that prevailed for many years for these materials at wholesale. Their availability however is probably considerably below that of the same constituents in the best commercial fertilizers; therefore these figures on value are fairly comparable with those for the commercial materials.

It has not been customary to assign a definite value to the organic matter in manure or commercial fertilizers. It should be duly credited in the purchase of all kinds of fertilizer, however, because of the important part it plays in the whole system of crop production and soil fertility.

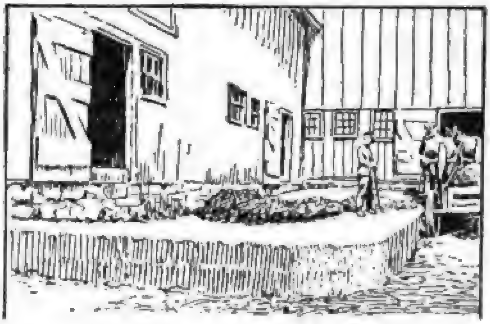


FIG. 15. ONE METHOD OF CONSERVING MANURE
A concrete platform slightly hollowed on which to collect the daily production

LOSSES OF MANURE IN HANDLING

Not all the manure of animals, especially work animals, is voided under conditions that permit its best storage and use. Such losses are inevitable and to eliminate them would interfere with the reasonable use and handling of the animal. With animals kept for some purpose other than work there is likely to be a similar but smaller loss. These losses can only be estimated. They may run from as much as forty per cent for the horse in regular work to fifteen per cent for meat and dairy animals kept in the stable or on pasture nearly all the time.

When manure is stored, whether in the stables, in a specially constructed pit, or in the soil, some loss is inevitable in the constituents that make it valuable. The important questions are: (1) Which method of handling manure entails the least loss, and (2) When in the system of cropping can the manure be applied to give the largest profit per ton used. The latter question is considered in some detail on page 58, but it is related to the problem of storing manure since the loss from storage may be as large as the gain from applying the manure at a particular point in the system of cropping.

The losses to which manure is subject may occur in four ways: (1) failure to preserve the liquid; (2) leaching by rain; (3) decomposition of the organic matter; (4) biological changes in the nitrogen of the manure by which it is converted into volatile forms that may pass off as vapor, chiefly as ammonia.

CONSERVATION OF LIQUID MANURE

The liquid manure should be retained by tight drops and floors. Clay floors absorb fifteen or twenty per cent of the liquid manure and floors of more porous soil a larger percentage. Concrete floors, now so generally in use, preserve the liquid manure very well, and are the most sanitary. Wooden floors may be made tight but are less sanitary and less easily cleaned.

ABSORBENTS AND LITTER

The large amount of liquid manure produced by most animals makes it difficult to handle. When absorbed by litter or bedding, it may be readily moved with the solid manure, and tight receptacles are not so necessary. Straw is the most commonly used absorbent in all grain-producing sections, and when cut into short lengths its absorbing capacity is increased. Any absorbent material may be used, but the six following points should be considered: (1) the absorbing capacity of the material; (2) its inherent manurial value for both organic matter and plant nutrients; (3) the possibility of fouling the stable and the animals when it has absorbed the liquid; (4) the possibility of injurious effects on the animals and the crops; (5) the cost and convenience of using the material; (6) the capacity of the material to absorb and retain ammonia, which is the chief form in which nitrogen is present and subject to loss. The approximate capacity of various materials for absorbing water and ammonia is shown in table 4.[1]

TABLE 4. CAPACITY OF DIFFERENT LITTERS FOR ABSORBING AND RETAINING WATER AND AMMONIA

Kind of material	Number of pounds of water retained by 100 pounds of material after 24 hours	Number of pounds of ammonia absorbed by 100 pounds of different materials
Wheat straw	220	0.17
Oat straw	285	....
Pea straw	280	....
Chopped corn stover	350	....
Partly decomposed oak leaves	162	....
Moss and forest leaves	275	....
Dead leaves	200	....
Needles of coniferous trees	175	....
Sawdust	435	0.05
Shavings	375	....
Spent tanbark	450	....
Air-dried humous soil	50	0.66
Peat	600	1.10
Peat moss	1,000	0.86
Sand soil	20	....
Loam soil	35	....
Clay soil	45	....
Muck soil	450	....

[1] Part of the data for this table was taken from *Manures and Fertilizers*, by Homer J. Wheeler.

The inherent manurial value of absorbent material varies, as is shown in table 5.

TABLE 5. APPROXIMATE COMPOSITION OF SOME COMMON BEDDING MATERIALS

Kind of material	In 100 pounds of air-dried material			
	Organic matter (pounds)	Nitrogen (pounds)	Phosphoric acid (pounds)	Potash (pounds)
Wheat straw	80	0.5	0.25	0.80
Oat straw	80	0.6	0.30	1.20
Corn stover	70	1.0	0.30	1.40
Peat moss	65	1.0	0.20	0.20
Muck	50	1.5	0.25	0.30
Dried forest leaves, oak	75	1.0	0.20	0.35
Pine needles	80	1.0	0.20	0.15
Sawdust	90	0.2	0.10	0.40
Shavings, soft wood	90	0.1	0.10	0.30

These figures do not reveal any large differences in the manurial value of bedding materials. The materials based upon the wood of trees have the lower value.

Straw, shavings, moss, and all fibrous materials are preferred as bedding to those of fine texture, such as soil and muck, which take on a semiliquid form when saturated and seriously foul the stable and the stock. Muck and peat are naturally rather full of water and must be dried to be of use. They may be brought from the bog in dry periods during the summer and placed in a pile under cover where the surface material will dry and can be raked off and used.

The possibility of injurious effects refers particularly to the composition of shavings, sawdust, and tanbark. A common constituent is tannic acid, which is particularly abundant in the wood and bark of the hemlock and the oak and is injurious to crop growth when the material is used in excessive amounts. Manure made up largely of such material cannot be used in hotbeds or for vegetable culture where very large amounts are applied, because it does not heat and decay readily and may directly injure plants. But in ordinary farm practice, where the application of manure is not more than twenty to thirty tons per acre, and where the manure is thoroly incorporated with the soil, such material is not considered objectionable.

For absorbing ammonia, one of the very best materials is moist soil. Both the water and the solid material take up that compound in rather large amounts. In fact field soil has a large capacity for absorbing all the soluble constituents of manure. Water alone will take up about seven hundred times its own volume of ammonia gas at ordinary room temper-

ature and nearly twice that amount at the freezing point. This has a bearing on the application of manure to the soil as well as in the use of soil as a stable absorbent. Dry soil, loamy sand, and dried muck are most commonly used to dry out poultry manure so that it can be stored. This capacity of the soil for absorbing the constituents of manure is best utilized by applying the manure directly to the field. The soil prevents any appreciable loss by leaching if it is not already full of water. The one case in which the direct application of manure to the land involves large loss is when the soil is wet and in need of drainage. Then the constituents do not come in close contact with the soil. Under any other condition the constituents of the manure are held in the upper layer of soil.

FIG. 16. THE MOST WASTEFUL METHOD OF STORING MANURE

CISTERNS

One of the best methods of storing liquid manure is in cisterns by means of a system of drains from the stables. The liquid does undergo some decay with resultant loss of ammonia, but the very complete exclusion of the air makes this less than in storage by any other method. Even in a cistern nine and a half feet deep there was in one investigation a loss of 21.7 per cent of the nitrogen in a period of eight months.

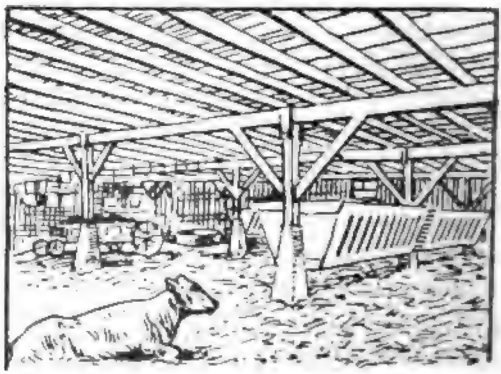


FIG. 17. AN EXCELLENT PLACE TO STORE MANURE
A covered barnyard or feed lot or a basement where the manure is accumulated with plenty of bedding and is thoroly packed by tramping, affords the proper conditions for storing manure

American farmers have not developed the habit or the facilities for handling liquid manure from the cistern to the field as have the farmers of some other countries. This is best accomplished by pumping the liquid from the cistern into a tank wagon in which it is carried to the field. It may be distributed by means of a large hose attached to the lowest part of the tank. On the discharge

end should be fitted a metal nozzle flattened to one-eighth to three-sixteenths inch opening so that it discharges a broad flaring sheet of liquid. Liquid manure is best applied on grassland early in the spring but is excellent on vegetable and forage crops.

CONSERVATION OF SOLID MANURE

Dung is subject to loss if it is leached by rain water. The process of digestion and decay makes a considerable part of this material soluble, so that it is readily removed by leaching. For this reason any method

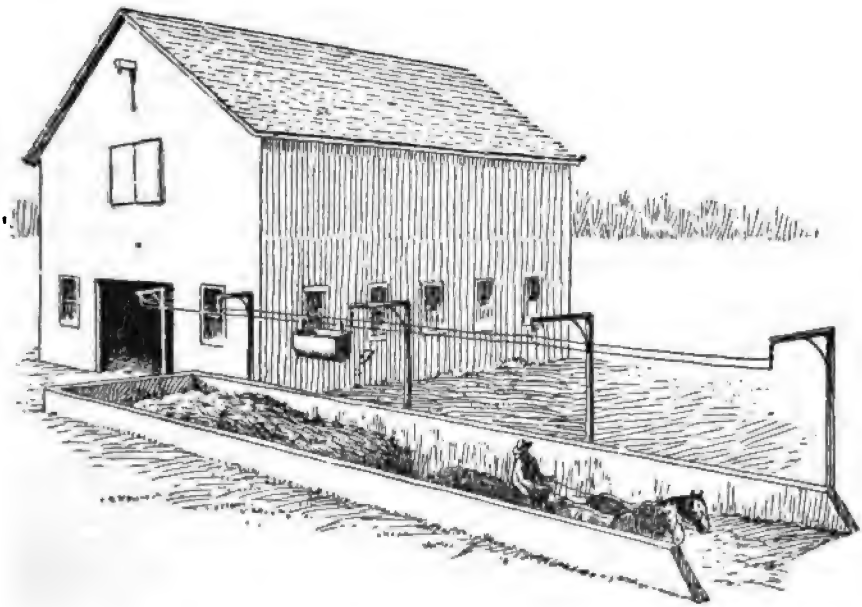


FIG. 18. AN OPEN PIT FOR STORING MANURE
The normal rainfall causes no loss of manure in a water-tight pit and the higher saturation reduces decay

of storage that permits rain water to pass thru the manure or even to displace a corresponding amount of the liquid already absorbed, results in loss. Consequently, storing manure in small, thin piles is especially wasteful. If the manure cannot be taken direct from the stable to the field and spread where the soil will absorb the leachings, it should be stored either in a pit or in a large compact pile of such form that heavy rains will be shed from the surface. In these large piles the average rainfall does not cause leaching, for it is usually offset by the intervening loss of moisture by evaporation. The occasional moderate rains during summer keep the outer layer of the manure pile moist and thereby reduce decay.

DECAY OF MANURE

The decomposition of manure may have two wasteful consequences: it destroys the organic matter; and it increases the solubility of the constituents, thereby making them more subject to loss by leaching. Decay is a slow process of burning or destroying organic matter, brought about by the innumerable forms of microorganisms in the manure heap. It has even been suggested that the voidings of some animals are made up largely of the bodies of these organisms. Such decay produces heat, as is shown by the high temperature of horse manure in heaps or in hotbeds.

The decay of any organic material is governed largely by the accessibility of air or oxygen. If the manure is moist, loose, and open, decay is rapid. If the manure is rather dense, decay is more slow. The difference in the rate of decay of manure from the horse or the sheep and that from the cow or the pig is caused by the difference in the physical character of these two types of manure (Table 3). The one decays rapidly, heats up intensely, and may even reach a stage of spontaneous combustion; the other decays slowly and does not heat much. If the supply of air is inadequate after the decay process has started, it continues in the anaerobic (without air) form, which is especially destructive of the combined nitrogen. The excessive heating of manure and its change to a chaffy, whitish condition is known as fire-fanging. This process is brought about by fungi rather than by bacteria, and the whitish appearance is due to the threads, or mycelium, of the fungi. In proportion as manure is kept wet and compact, the rate of decay is reduced. Storage in large piles and the mixing of cold wet manure with that which is loose and porous, are good practices. Manure that is stored in covered yards and box stalls from a mixed lot of stock is very well preserved for these reasons. It may even be permissible to spray water on the manure heap until it is saturated, in addition to tramping it.

The increase in the solubility of manure brought about by decay is shown in table 6.

TABLE 6. EFFECT OF DECAY ON THE SOLUBILITY OF MANURE

	Percentage in fresh manure	Percentage in rotted manure
Water	66.17	75.42
Soluble organic matter	2.48	3.71
Soluble organic nitrogen	0.15	0.30
Soluble inorganic matter	1.54	1.47
Insoluble organic matter	25.76	12.82
Insoluble inorganic matter	4.05	6.58

The process of decay affects especially the nitrogen, which is largely in the form of urea, a compound that changes rapidly into volatile forms. The sharp pungent odor around manure heaps is largely due to the ammonia thus formed, which passes off into the air. Any treatment that checks the general decay process conserves the nitrogen.

Because of the volatile nature of ammonia it has been proposed to apply materials that unite with the ammonia and prevent its escape as a vapor. Any of the stronger acids will serve this purpose. Sulfuric acid is the most effective, but is impractical to handle under farm conditions. Recent investigations indicate that powdered sulfur might be used, as it is rapidly converted into sulfuric acid by bacterial processes. This material has not been tried out in practice and should be used with caution. Compounds of sulfuric acid that undergo change in contact with the ammonium carbonate of the manure, may be used. Land plaster, or gypsum ($CaSO_4$), has been suggested but proves to be of very low efficiency. Acid phosphate, which is a mixture of land plaster and monocalcium phosphate, is considerably more effective. A laboratory test of the efficiency of these materials on liquid manure that was evaporated to dryness, showed the following results:

	Percentage of nitrogen lost
Sulfuric acid	2.68
Acid phosphate	27 to 37
Land plaster	50

Raw rock phosphate and ground limestone do not conserve the ammonia except in so far as they conserve the liquid. Some farmers use a rather coarse grade of ground limestone on cement floors to prevent the animals from slipping. No caustic materials, such as quicklime, air-slaked lime, and wood ashes, should be used on manure, for their alkaline properties drive the ammonia out of the manure. Acid phosphate and land plaster are commonly sprinkled on the manure in sufficient quantity to form a good coating, or they are applied at the rate of forty to sixty pounds per ton of manure. In poultry houses a good grade of acid phosphate may be kept in boxes before the roosts so that the hens can dust themselves in it and thus spread it. The phosphate may be sprinkled over the droppings whenever the odor of ammonia is noticed.

Phosphates and lime may be used on manure for a totally different purpose, namely, to add to it constituents that are particularly needed by the soil and in which the manure is deficient. Raw rock phosphate, as well as acid phosphate, is used for this purpose. The decay of the organic matter in the manure probably increases the availability of phosphorus in the raw rock. Applying lime in the form of ground limestone to the soil in this way saves some labor.

DETERMINATIONS OF LOSS

It has been stated that there is an inevitable loss in handling manure. Figures showing the extent of this loss may serve to increase the care employed in handling it. At the Cornell University Agricultural Experiment Station [2] two tons of horse manure and five tons of cow manure were each lightly packed in a box, the latter with three hundred pounds of gypsum, and let stand exposed to the weather from the latter part of April until the first of October. The results of this experiment are given in table 7.

TABLE 7. LOSS OF MANURE IN STORAGE AT CORNELL

	Number of pounds at beginning of experiment		Number of pounds at end of experiment		Percentage of loss	
	Horse	Cow	Horse	Cow	Horse	Cow
Gross weight	4,000	10,000	1,730	5,125	57	49
Nitrogen	19.6	47	7.79	28	60	41
Phosphoric acid	14.8	32	7.79	26	47	19
Potash	36.0	48	8.65	44	76	8

The decrease in gross weight probably gives a very good indication of the loss of organic matter, which was not determined. The material underwent decay and leaching.

Shutt,[3] of the Canadian Department of Agriculture, exposed mixed manure from horses and cows in bins, both with and without shelter from the weather, for a period of one year and found the losses given in table 8.

TABLE 8. LOSS OF MANURE IN STORAGE AT CANADIAN STATION

	Percentage in protected bin	Percentage in unprotected bin
Loss of organic matter	60	69
Loss of nitrogen	23	40
Loss of phosphoric acid	4	16
Loss of potash	3	36

By far the largest part of the loss occurred in the first three months of exposure. During that time occurred ninety per cent of the total loss of

[2] The production and care of farm manures. I. P. Roberts. Cornell University Agricultural Experiment Station. Bulletin 27.
[3] Barnyard manure: its nature, functions, composition, fermentation, preservation and application. Frank T. Shutt. Canadian Department of Agriculture, Central Experimental Farm. Bulletin 31.

organic matter and seventy-five per cent of the loss of nitrogen, in both the protected and the unprotected bins. Scarcely any of the phosphoric acid and potash was lost from the sheltered bins during this period, but more than half of the total loss of those elements occurred in the bins exposed to the weather. These figures very clearly show the large loss that occurs from decay alone even without leaching. This loss falls especially heavy on the two most valuable constituents of the manure — the organic matter and the nitrogen, which are changed into volatile forms. The manure used in this experiment doubtless did not contain all the liquid corresponding to this solid material; hence the loss of nutrients, particularly nitrogen, appears smaller than it actually was.

At the Ohio Agricultural Experiment Station, manure in lots of one thousand pounds each was exposed from January to April, the period in which the loss might be expected to be least. Analyses show that the loss in five different piles averaged twenty-five per cent of the organic matter, twenty-eight per cent of the nitrogen, and twenty per cent of the ash, or mineral elements.

These figures are typical of all that have been obtained on the loss of manure in storage. They show that in a relatively short time half of the organic matter, nitrogen, and potash, and a quarter of the phosphoric acid, may be lost. The greater the loss of the liquid, and the longer the manure is exposed to decay and to leaching, the larger is the total loss.

APPLICATION OF MANURE

In general farming, the best practice is believed to be to apply the manure to the land as rapidly as it is made. The soil and the crop, if there be one, are depended on to reduce the loss to a minimum. The manure should be distributed at once and not left in small piles; the latter is the most wasteful of all methods of handling manure. The absorptive capacity of the soil for all the constituents is large. The organic matter probably suffers the largest loss. For this reason it is better to incorporate the manure with the soil immediately. The deeper it is plowed under, the slower is the rate of decay.

Large loss is likely to occur if the ground is saturated with water or covered with ice; light snow is not detrimental. Manure may be successfully applied on a moderate slope. If manure must be stored and cover is not available, it should be kept, all kinds together, in a large, compact, thoroly moist pile. The most successful gardeners store their manure in the summer in large piles four to five feet high and flat or saucer-shaped on top so as to collect the rain. A pile of this height has sufficient water capacity to absorb almost any amount of rainfall that ordinarily

occurs. This in part offsets the loss by evaporation so that the pile is kept more moist than if it were built so as to shed the rain. The latter form is best for winter storage.

The percentage of the constituents that may be saved when manure is stored in concrete pits as compared with piles, has not been accurately determined. Assuming that the difference in loss were fifteen per cent of the organic matter, nitrogen, and potash, for an animal weighing one thousand pounds this loss would amount annually to about six dollars, or sufficient to pay six per cent on one hundred dollars. On a herd of twenty animals it would warrant a capitalization of two thousand dollars for a manure pit, assuming that the labor of distribution were the same, which of course is not true. It is conceivable that the saving may be larger.

Serious disadvantages of applying manure direct from the stable to the fields are as follows: There are times when the manure cannot be put on the land, due to snow or rain or growing crops. The loss of organic matter and nitrogen from manure spread direct from the stable, while not determined, is probably considerable, and increases the desirability of storage. The manure pit is therefore likely to find a more important place on the stock farm than it has been given heretofore.

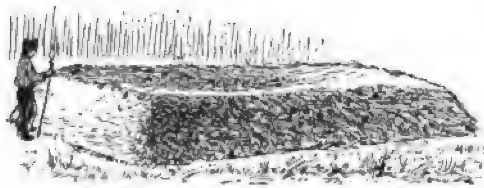


FIG. 19. CORRECT FORM OF MANURE PILE FOR SUMMER STORAGE

PLACE OF MANURE IN ROTATION

It is not easy to decide just where and how on each farm the manure may be applied to best advantage. In general, forage and vegetable crops make better use of manure than do grain crops. Organic matter and nitrogen, in which the material is rich, promote vegetative growth.

On the mixed-crop farm where grass is let stand three to four years, the use of manure as top-dressing on new seeding greatly increases not only the growth of the grass but the residue of the manure, and the roots and stubble of the grass increase the succeeding grain crops very perceptibly. At the Cornell University Agricultural Experiment Station the application of ten tons of manure per acre to grassland for two years in three increased the six-years average yield of hay two hundred and fifty per cent. Twenty tons per acre increased the yield three hundred and fifty per cent. The yield was increased from one to two and one-half and three tons, respectively.

Valuing the manure at $1.50 per ton, and the hay at $12 per ton, the value of the increased yield of hay above the cost of the manure was

\$23.50 for the application of ten tons for the three-years period, and \$31 for the application of twenty tons. In addition, the ten tons of manure increased the value of the three succeeding grain crops in the rotation — corn, oats, and wheat — to the amount of \$34.61, and the twenty tons \$45.55. The total increase in the value of the crop was \$88.11 when ten tons were applied, and \$136.55 when twenty tons were applied. In this rotation the manure had a gross value per ton of \$4.40 when ten tons were applied, and \$3.40 when twenty tons were applied.

At the Ohio Agricultural Experiment Station the value of a ton of manure as an average for all rotations in a general farming system over a period

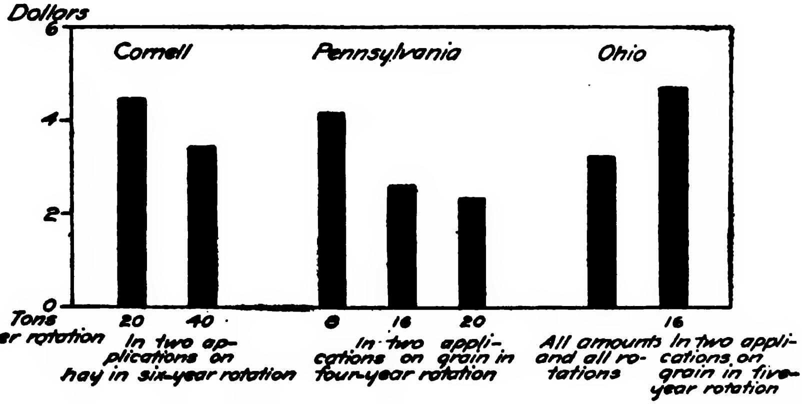


FIG. 20. THE VALUE OF A TON OF MANURE

At the Cornell Experiment Station the rotation was three years of hay followed by corn, oats, and wheat, and the manure was applied on the first and third hay crops. At Pennsylvania State College the rotation was corn, oats, wheat, and hay, and the manure was applied on the corn and the wheat. At the Ohio Experiment Station the rotation was corn, oats, wheat, clover, and timothy, and the manure was applied on the corn and the wheat. The value at which crops were calculated varied somewhat at the different stations

of years, has been about three dollars. Eight tons of manure in two applications on corn and wheat respectively in the third period of a five-years rotation of corn, oats, wheat, clover, and timothy, have a gross value of \$4.69 per ton.

The farm value of a ton of manure must not be confused with the trade value of its constituents. The latter is given in table 3. The former depends on many factors — the condition of the soil, the value of the crop, the cost of applying the manure, the amount used, the cost of commercial fertilizers, and other things. In general the higher the acre value of the crop, the greater is the value of a ton of manure, assuming that it is required by the soil. Further, the smaller the acre application, the higher is the value of a ton of manure, altho the total acre value of the

increase will be less. This point is made clear in table 9, which is based on results from the Ohio Experiment Station.[4]

TABLE 9. INCREASE DUE TO A TON OF MANURE WHEN APPLIED IN DIFFERENT AMOUNTS

Number of tons of manure applied per acre	Wheat		Clover		Potatoes	
	Bushels	Valued at $1 per bushel	Pounds	Valued at $10 per ton	Bushels	Valued at 50 cents per bushel
4.............	8.0	$8.00	177	$.87	37.3	$18.65
8.............	4.1	4.10	150	.75	19.4	9.70
16............	2.4	2.40	99	.50	11.6	5.80

In the general farming rotation from five to ten tons per acre of manure on the non-legumes and on the more critical crops is as much as can be used on the average soil with profit. On the other hand several times these amounts may be used profitably on farm and garden vegetables.

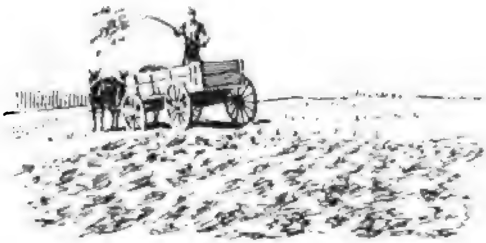


FIG. 21. SPREADING MANURE BY HAND
The distribution is uneven, and the application must be relatively heavy to cover the ground

MANURE SPREADERS

Light applications of manure can be made effectively only by the use of manure spreaders, of which there are many types. Not only can the manure be made to go farther and to be more effective, but under favorable conditions the cost of application is reduced. The newer types of spreaders are low and hence are easier to load. The time consumed in unloading and spreading is reduced by at least half, and the distribution is much more efficient than by hand. Further — a point that is of vital importance — a ton of manure can be spread over more ground with a spreader than by hand. Five to ten tons per acre, the amounts most profitably used on

FIG. 22. SPREADING MANURE BY MACHINE
The manure spreader increases the efficiency of the manure

[4] Plans and summary tables of the experiments at the central farm, Wooster, and the northeastern test farm, Strongsville, on the maintenance of soil fertility. Ohio Agricultural Experiment Station. Circular 144.

the average mixed-crop farm, cannot be made to thoroly cover the ground by hand spreading, and therefore the efficiency of the manure is reduced.

This fact is illustrated in a general way in table 10, which was compiled by Dr. W. E. Taylor from the results of an experiment carried on by Chesney Hatch, on his farm in Newton County, Indiana.

TABLE 10. EFFICIENCY OF MANURE SPREADING WITH MACHINE AND BY HAND

Treatment	Kind of grain	Number of acres	Time planted	Amount harvested	Loads of manure per acre	Value of crop	Value of crop per acre
Manure spread with a spreader	Corn	10	May 5	620 bushels	5	$248.00	$24.80
	Oats	10	April 6	560 bushels	5	156.80	15.68
	Clover	10	April 6	30 tons	4	150.00	15.00
Manure spread by hand	Corn	10	May 4	500 bushels	5	$200.00	$20.00
	Oats	10	April 6	420 bushels	5	117.60	11.76
	Clover	10	April 6	21 tons	4	105.00	10.50
Crop raised without manure	Corn	5	May 6	200 bushels	None	$80.00	$16.00
	Oats	5	April 6	190 bushels	None	53.20	10.64
	Clover	5	April 9	7½ tons	None	37.50	7.50

TOP-DRESSING VERSUS PLOWING UNDER

The quickest effect of manure is obtained when it is applied as a top-dressing on plowed land and thoroly worked into the soil to a depth of three to five inches. Here it undergoes rapid decay and is quickly taken up by the plant roots.

FIG. 23. A MODERN MANURE SPREADER

The most lasting effect of manure per ton is produced by relatively deep rather than relatively shallow application. When manure is plowed under, it decays more slowly and its effect is prolonged over more years than when left on the surface. This depends however on the soil and on the rotation. The same effect may be obtained from a ton of manure worked in deeper on sandy soil than on clay, and on well drained than on poorly drained land.

A good indication of the depth at which organic matter is most available and at which it ceases to be available in the soil may be gained by examining the butts of fence posts that have been in the ground for many years. They are usually most decayed about the surface of the ground and progressively less decayed toward the bottom, varying with the

ventilation of the soil. The decay of manure at different depths will be at the same rate (fig. 24).

Lack of organic matter and nitrogen are the two most immediate limiting factors of plant growth on the average soil. Since these are the primary constituents of manure, it is exceedingly important that it be conserved and applied.

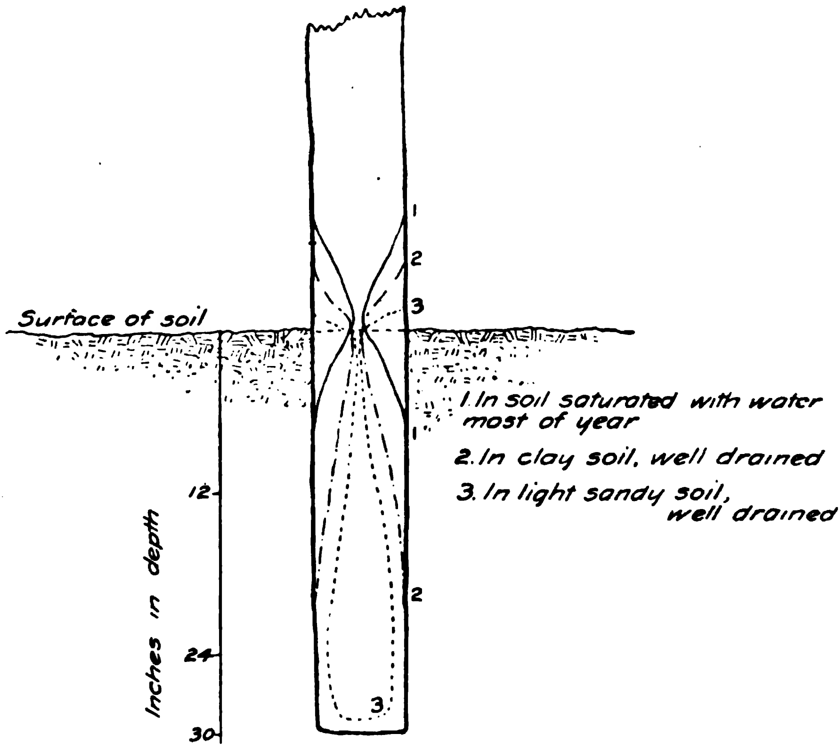


FIG. 24. THE RATE OF DECAY OF ORGANIC MATTER IN THE GROUND

Old fence posts indicate how deep manure may be plowed under. A fence post that has stood in the ground for many years undergoes decay in the part in and near the soil, and the form of the decayed end shows at what depth decay is most rapid and how deep active decay extends. To incorporate manure below that depth is to place it largely beyond reach of the roots of crops. The extent and the depth of decay depends on the fineness and the drainage of the soil

ANIMAL HUSBANDRY AND SOIL MAINTENANCE

The conservation and use of manure is primarily a problem of soil maintenance. Unless farm animals are profitable for their main products, it is doubtful economy to keep them for their manure alone. As manure is ordinarily handled, the loss is easily fifty per cent of all the constituents. When the material used by the animal is added to this, the net return to the soil from the feed is about twenty per cent of the

organic matter, from twenty to forty per cent of nitrogen, from forty to forty-five per cent of the potash, and about fifty per cent of the phosphorus.

The vital constituents are the organic matter and the nitrogen. Without animals, these can be obtained in equal amounts from one good clover crop returned to the land every five years. It is quite as practicable to haul a clover crop from a good field to a poor field as to haul all the crops to the barn, feed them, and haul back to the field an equal or larger amount of bulky, watery manure. The relative advantage depends entirely on the details of the two systems and the profits obtained.

SUMMARY

1. The animals on farms in New York produce annually about thirty million tons of manure, which is sufficient for an application of three and a half tons annually on each acre of tilled land in the State.

2. The chief valuable constituents of manure are organic matter, nitrogen, phosphoric acid, and potash. The effects of these on the soil are many and have to do vitally with the physical conditions of the soil and its supply of available plant-food.

3. Animals divert for their own use nearly two-thirds of the organic matter in the food consumed, from one-fourth to one-half of the nitrogen and phosphorus, and from one-tenth to one-fifth of the potash. Dairy cows and hens divert a larger proportion of these constituents than do other farm animals because of the nature of their products.

4. The total amount of manure produced annually per thousand pounds of live weight of the farm animals varies from five tons for the hen to about fifteen tons for the pig. This difference is primarily in the amount of water incorporated in the manure. The amount of dry matter in the manure, like the amount of food consumed, is very similar for all animals; it averages about 4500 pounds. The proportion of urine to dung varies from about 30 per cent for the horse to about 67 per cent for the pig.

5. The urine has a higher value per ton than the dung, due to its larger content of nitrogen. Its annual value however is only about one-half that of the dung.

6. The amount of plant nutrients in the manure produced annually per thousand pounds of live weight varies from 114 to 136 pounds of nitrogen, from 40 to 80 pounds of phosphoric acid, and from 90 to 126 pounds of potash. The amounts contained in a ton of manure made up of a mixture of all the urine and all the dung are 10 to 26 pounds of nitrogen, 3 to 15 pounds of phosphoric acid, and 9 to 18 pounds of potash.

7. The plant nutrients in the manure per year per thousand pounds of live weight have a commercial value at the price of the nutrients

used of about twenty-seven dollars, and the organic matter has a value of about nine dollars, making a total value of about thirty-six dollars per year. The range in commercial value per ton of manure — urine and dung — is from $2.30 for the pig to $7.25 for the hen. The commercial value per ton of air-dried material is about fourteen dollars for all animals except the cow, for which it is about eleven dollars.

8. Manure undergoes loss by decay, by leaching, and by failure to conserve the liquid manure. This loss may be very large where little or no care is taken to save the material. Investigation indicates that by the ordinary method of storage in rough yard piles the loss in three months is more than half of the organic matter, nitrogen, and potash.

9. Manure may be conserved either by proper storage or by spreading it on the soil as fast as it is made. Probably not over three-fourths of the manure produced can be utilized by the best possible method of handling, and the proportion may be as low as one-fourth.

10. Manure is best stored in large compact piles or in watertight pits, so that the liquid will be absorbed by litter and decay prevented.

11. The nitrogen and the organic matter are lost by decay and by passing off as vapor even without exposure to rain or leaching.

12. Acid phosphate is the best practicable amendment to use with manure to conserve the ammonia. Land plaster is relatively inefficient. Limestone and raw rock phosphate have no conserving effect except as absorbents. Any caustic material, such as lime or ashes, should never be applied to manure.

13. Forage and vegetable crops make the best use of manure. Light applications produce better returns per ton than heavy applications. For general farm crops, five to ten tons should be used per acre. The application should also be gauged by the value of the crop. The use of manure as top-dressing on new grass seeding is good practice.

14. The largest and quickest results from manure are obtained by using it as top-dressing on plowed land and immediately and thoroly incorporating it with the soil. Plowing under manure conserves the organic matter and is likely to increase the total effect.

15. Manure spreaders are essential for the most efficient and economical use of manure on the general farm.

16. Wasteful handling of the manure may make animal husbandry more destructive of soil fertility than is careful farming without stock. The net return to the soil in the manure of the constituents in the food consumed by an animal, is never over thirty per cent of the organic matter and sixty per cent of the nitrogen and potash, and it may be as low as ten per cent of the organic matter and twenty per cent of the nitrogen and mineral constituents.

ADVANCED READING

Farm manures. Charles E. Thorne. Orange Judd Company, New York City.

Fertilizers and crops. L. L. Van Slyke. Orange Judd Company, New York City.

Soil fertility and fertilizers. J. E. Halligan. The Chemical Publishing Co., Easton, Pennsylvania.

Manures and fertilizers. Homer J. Wheeler. The Macmillan Company, New York City.

Manures and the principles of manuring. C. M. Aikman. D. Van Nostrand Company, New York City.

The fertility of the land. I. P. Roberts. The Macmillan Company, New York City.

The changes taking place during the storage of farmyard manure. E. J. Russell and E. H. Richards. The Journal of Agricultural Science **8**:495–563. 1917.

For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C.

Barnyard manure. U. S. Department of Agriculture. Farmers' bulletin 192. Price 5 cents.

Fertility of soils as affected by manures. U. S. Department of Agriculture, Bureau of Soils. Bulletin 48. Price 10 cents.

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98	Practical examples in dairy arithmetic
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76	Birds in their relation to agriculture in New York State
94	The farm fishpond
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59	Sewage disposal for country homes

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 127 THE SOIL SERIES AUGUST, 1917

FARM MANURE

ITS PRODUCTION, CONSERVATION, AND USE

DISCUSSION PAPER

The discussion paper takes the place of the teacher in encouraging thought and self-expression on important points in the lesson, and in giving an opportunity for questions by the reader. Each discussion paper filled out and returned is read carefully, and a personal reply is made to questions on any agricultural subject. In order to continue a course, the reader should sign and return the discussion paper so that another lesson may be sent. Questions are included on the discussion paper for the purpose of assisting those readers who desire to give the lesson special study. The preparation of answers is optional.

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(*Detach, sign, and return for the next lesson in this series.*)

(In answering questions, attach additional paper if needed and number the answers.)

1. How much manure is produced on your farm annually from each type of animal?

2. What part of this manure is actually saved and put on the land in such a way that it is effective in the production of larger crops?

3. What are the important constituents of manure?

4. What part of each of these constituents in the feed is regained in the manure?

5. How much manure will a thousand pounds live weight of each of the following animals produce annually in total: horse, cow, pig, sheep, hen?

6. What are the effects of manure on the soil?

7. What is the value of a ton of manure on your soil and on the crops there produced?

8. What methods are in use in your region for the conservation of manure?

9. Where in the rotation do you find that it pays best to apply manure?

10. What method of handling manure seems to be most profitable in your region: storage or direct application; before plowing or after plowing; plowing under deep or shallow; distribution by hand or with spreader?

11. What is the character of your soil?

12. Do you know of any one who is storing liquid manure in a cistern? How is it applied to the land? With what results?

Name...

Address...

Date...

(Address all correspondence to the Reading Course for the Farm, College of Agriculture, Ithaca, New York.)

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LESSON 128 FLOWER GROWING SERIES SEPTEMBER, 1917

AUTUMN IN THE FLOWER GARDEN

DAVID LUMSDEN

A FLOWER-FRAMED DRIVEWAY

The white flowers on either side of the driveway are Japanese anemones, or windflowers. They are excellent for autumn effects, and have been preceded by German iris, perennial larkspurs, and Canterbury bells

Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

THE FLOWER GARDEN

DOUGLAS JERROLD

And there a brook should murmur with a voice of outdoor happiness; and a little garden brimming over with flowers should mark the days and weeks and months with bud and blossom; and the worst injuries of Time be fallen leaves. A garden is a beautiful book, writ by the fingers of God; every flower and every leaf is a letter. You have only to learn them — and he is a poor dunce that cannot, if he will, do that — to learn them and enjoy them, and then go on reading and reading, and you will find yourself carried away from the earth to the skies by the beautiful story you are going through. You do not know what beautiful thoughts — for they are nothing short — grow out of the ground, and seem to talk to a man; and there are some flowers, they always seem to me like ever dutiful children; tend them ever so little, and they come up and flourish, and show, as I may say, their bright and happy faces to you.

AUTUMN IN THE FLOWER GARDEN

DAVID LUMSDEN

A FLOWER garden is of interest to men, women, and children alike, and the planning of a garden may well occupy the spare moments of each member of the family during the long evenings of the winter. The cultivation of a garden tends to foster a sense of kinship with the other persons having a love for the beautiful. It has been stated that the house and the grounds make the home; therefore the grounds as well as the house should reflect the personality of the owner.

Every one interested in the trend of modern horticulture has been delighted to observe the renewed interest in the old-fashioned garden, which embraces such plant material as was in evidence many years ago in the section of the grounds designated as "grandmother's garden." The plant material used was largely of the hardy herbaceous kind, such as larkspur, iris, hollyhock, phlox, peony, Michaelmas daisy, day lily, madonna lily, columbine, spiræa, poppy, evening primrose, rocket, lupine, foxglove, anemone, bluebell. The reasons for the general planting of these hardy herbaceous or perennial plants are obvious; when once planted in good soil they come up season after season and provide a beautiful floral display with little attention on the part of the individual beyond an annual dressing of decayed manure spread over the border.

PREPARATION OF THE SOIL

Thoro tillage of the soil is absolutely essential for best results, whether shrubs, herbaceous plants, or annuals are to be grown. There is no substitute operation that will take the place of thoro preparation of the soil. This fact would appear to be a truism, but nevertheless the initial preparation of the soil is often neglected or the work done superficially. When preparing the soil, it must be remembered that this work is being accomplished not for one season but for several, hence the importance of doing it thoroly.

The soil may be prepared either in the fall or in the spring. The digging or the trenching, which is better, should be done to a depth of two to

two and one-half feet, so that there may be if possible two feet of good prepared soil to receive the plants. This deep preparation of the soil lessens the need of continuous watering so often practiced in American gardens. When the ground is spaded, all roots of trees or shrubs and all weeds should be removed. If the soil is clay, the addition of sandy loam will benefit it greatly; on the other hand, if it is sandy loam, then clayey loam may be added. A dressing of well-decayed manure covering the ground to the depth of two inches should be applied and well incorporated into the soil. For light soils cow manure is preferable, while for heavy or medium heavy soils horse manure may be used. Decaying leaves are also valuable to spade into the border, as they are one of the sources of humus.

FIG. 25. COLUMBINE, A VERY SATISFACTORY HARDY BORDER PLANT
The period of bloom may be extended thruout the whole summer if the seed vessels are cut off as soon as they form

An occasional dressing of lime on the flower border is beneficial, especially if the soil is somewhat acid. Lime not only neutralizes soil acidity, but also improves the physical character of soils, promotes decomposition, making plant-food available, and enters into the composition of plants. Lime should be applied in the spring in preference to the fall. Lime should never be applied with manure, because it releases the ammonia. The quantity of lime to use varies according to the acidity of the soil, but in general one pound of hydrated lime to twenty-five square feet should be sufficient. The lime should be applied evenly over the surface of the ground and worked into the soil with a garden rake.

If the soil is likely to be wet, some system of drainage may be necessary; but, as a general rule, in very few cases does the garden need to be drained.

FIG. 26. GOOD PLANTING AND PLEASING COLOR HARMONY
The tall blue perennial larkspurs screen the wall and form a background for the low creamy white Japanese spiræa

55 865

In fact, it is good to have some moisture in the soil during the warm, dry summers. After preparing the soil, it should be allowed to settle for a day or two before setting out the plants.

PROPAGATION OF HARDY PERENNIALS

Hardy perennial plants are propagated from seed, by division of the roots in the early spring as the plants commence growth, and by cuttings.

SEEDAGE

Seeds of perennial plants should be sown in coldframes from May until early in August. The seedbed should be of equal parts of light friable loam and leaf mold with sufficient sand added to it to keep the compost open. After the soil is spaded thoroly, the surface of the bed should be brought to a fine tilth by smoothing it with the back of a garden rake. Drills about one-eighth inch deep and four inches apart should be made lengthwise of the frame. For convenience, the straight strip or narrow piece of board used for making these drills should be the exact length to fit inside the frame. The seeds should be sown evenly and not too thickly in the drills. They should be covered very lightly with screened loam and then watered with a fine sprinkler. The sash should be replaced on the frame, and a slight coat of shading applied to the glass to keep the warm sun from drying out the bed and to assist in conserving moisture during the germination period. Cheesecloth stretched on frames the exact size of the sash forms an excellent shade under which to start seeds. The frames should be kept as cool as possible by admitting air, and the ground should be kept moist, not wet, until the seeds germinate. Germination usually takes place from ten to twenty-five days from the time the seed is sown.

FIG. 27. A BUNGALOW MADE GAY WITH HOLLYHOCKS

Light-colored flowers are more pleasing for use near the house; therefore soft shades of yellow and pink were combined in this planting

When the plants show their true leaves, they should be transplanted into other frames and spaced four inches apart each way. They should

be watered thruout the fall, and as winter approaches covered directly on top with hay, straw, or leaves. The sash should be replaced on the frames, and, for further protection, straw mats should be placed over the sash. Protected in this manner hardy perennial plants will winter over and remain dormant until the middle of March, when all coverings should be removed and the frames aired on all seasonable days. The plants should be set out in permanent quarters as soon as the ground is workable.

Hardy perennial plants generally require two or three years to reach full maturity. Such plants as peonies, iris, lilies, and the like, take much longer, hence the importance of very carefully looking over their requirements regarding cultivation during this period. Timely transplanting is essential; weeding must be attended to; and an occasional cultivation of the soil after transplanting is very beneficial to the plants.

FIG. 28. A GOOD PLANTING AROUND A PORCH

The clematis vines (*Clematis paniculata*) add coolness, charm, and privacy to the porch. Petunias, variety Rosy Morn, and sweet alyssum are planted around the foundation, and pink geraniums, marguerite daises, and fountain plants fill the boxes

DIVISION

Propagation by division of the roots insures the reproduction of varieties that in many cases would not come true from seed. Most of the plants recommended for the hardy garden may be divided with the greatest ease; a few require special care. Among those that are readily and easily divided are sunflowers, Michaelmas daisies, phlox, and chrysanthemums. The roots of these plants may be readily pulled to pieces or divided by inserting the blade of a strong knife or the edge of a sharp spade thru the clump of roots, severing them into portions containing from three to five growths. Peonies and other plants having large rootstocks and plants the roots of which are crossed, are best divided by first washing away the soil and then carefully pulling apart the roots, using a sharp knife to sever the division from the main stem and observing most closely that there are one or more growing buds to each section, or division. For most hardy perennials this method of propagation should be practiced in early spring.

FIG. 29. A GOOD POSITION FOR A PLANTING OF HOLLYHOCKS

They join the house with the ground, and fill the space made by the graceful curve of the path to the back yard. This light-colored variety was chosen because it was especially suitable for use near the house

CUTTINGS

The advantages in propagation by cuttings are that young plants may be quickly raised, and species and varieties may be kept true to type. Such plants as larkspur, hardy garden phlox, and Scotch pinks may be propagated by this method. For propagating by the cutting method, soft wood growth in which woody fibers, fibro-vascular bundles, have not yet formed, should be selected. Portions of growth hardened by age or exhausted by flowering are of little use for propagating. If plants are cut back after flowering, they will produce young growths suitable for cutting material. The cuttings should be made from two to three inches

FIG. 30. A PLANTING EFFECT PRODUCED IN ONE YEAR

The low bushes in front are barberry, and the flower border along the side of the house is of tender annuals

in length, the lower leaves removed, and the cut made in a horizontal direction close to the base of the leaves, directly under the joint known as the node. These cuttings root best in warm atmosphere. If a greenhouse is not available, a hotbed may be made. The heat is furnished by decomposing horse manure, over which should be placed three to four inches of clean, sharp sand, or one-half sand and one-half light, fibrous, screened soil.

Plants may be propagated by root cuttings in the following way. Portions of the roots are cut into pieces about one and one-half to two inches long, and inserted in rows in the sandy soil of the hotbed or placed in shallow boxes containing sandy soil. The tops of the cuttings should

just protrude from the soil. If a greenhouse is available, this method of propagation should be done in the winter; if a hotbed is used, March and April are preferable. A temperature of from 50° to 55° F. suits the cuttings best. Root cuttings should receive practically the same treatment as other cuttings. When they have started, they should be transferred to small flowerpots and given some protection before being bedded. Phlox, bergamot, stokes' aster, gaillardia, sea lavender, globe thistle, oriental poppy, Japanese anemone, and other perennials are readily propagated by this method.

DIRECTIONS FOR PLANTING

WHEN TO PLANT

Shrubs and hardy perennial flowers may be transplanted with success either during April and May or during October and early November.

WHERE TO PLANT

It is as important to know where to plant as it is to know when and what to plant. In many instances much plant material has been set around the house, but unfortunately it has not been planted in the right place to create the best effects.

In planning the home grounds it is first necessary to prepare a plan or a rough sketch on paper, and to study carefully the plants that are to be used in the arrangement. Perhaps the best place to grow flowers, especially on the farm, is in a border on the side of the lawn, in front of shrubbery, or against the foundation of the house. Nine feet is a very satisfactory width for the border. The three feet along the back should be set with tall plants four to six feet apart. A few flowering shrubs and ornamental foliage plants and grasses, such as lilacs, Chinese crabs, rugosa roses, Japanese bamboos, miscanthus, and giant reeds, add to the attractiveness of this back row. It is admissible to place flowers in beds bordering the walks, and roses, both hybrid perpetuals and hybrid teas, are most useful for this purpose. The center of the lawn should not be cut up in order to create a flower bed. The lawn should be the open foreground in the home ground picture and is much more satisfactory when preserved in one unbroken surface.

WHAT TO PLANT

Most of the flowers for the farm home should be herbaceous perennials, including all the old-fashioned flowers previously mentioned. The new improved forms of these are especially noticeable in purity of tone, size of flower, and compactness of growth. Herbaceous perennials, when

established, will come up every year without further trouble, but they should be lifted and divided every three or four years. They take less

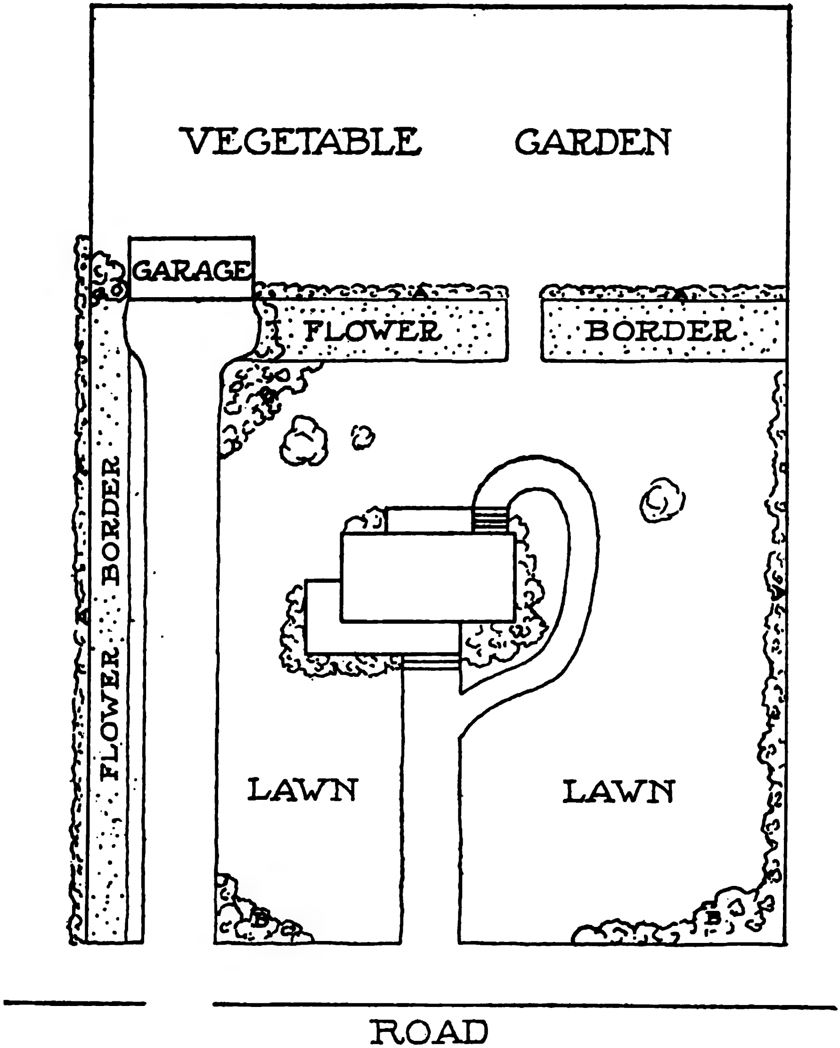

FIG. 31. PLAN SUITABLE FOR A SUBURBAN HOME

Flower borders and evergreen hedges (A) skirt the driveway and screen the vegetable garden from the lawn. Shrubbery (B) is used at the edge of the lawn and near the house

attention and are generally more satisfactory than annuals. The latter, however, perform a very useful service if planted in the herbaceous border to bridge over the time between the flowering of the various perennials.

HOW TO PLANT

The plants should be set in the border according to height, with the taller ones at the back and the lower ones toward the front. The grading should not be too pronounced, as an uneven line is much more pleasing.

In setting plants the roots should not be crowded into a small space, but should be allowed ample room to spread, and the earth should be pressed firmly around them. If the weather is warm and dry, the plants

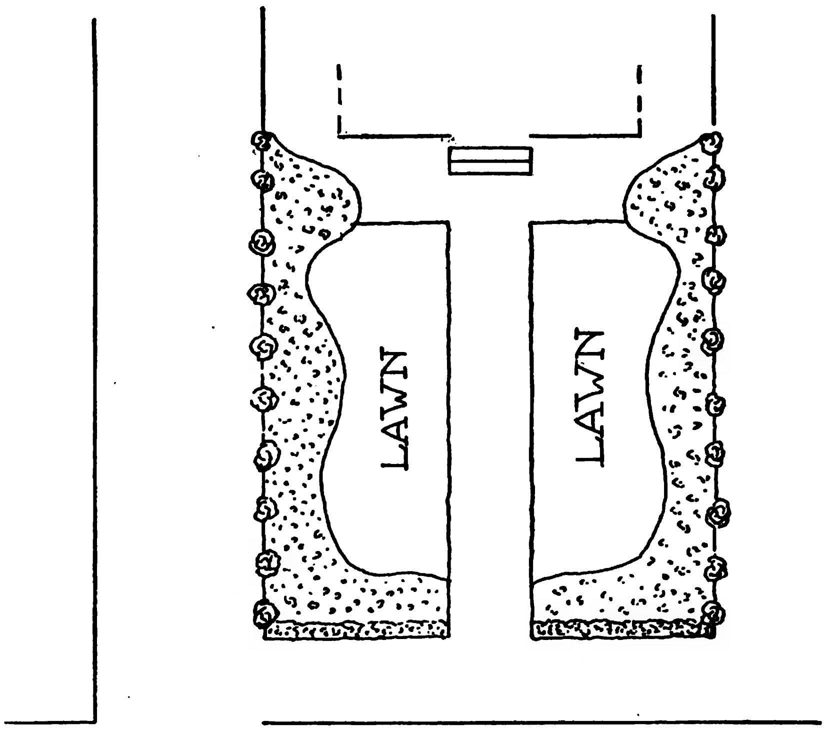

FIG. 32. AN OPEN LAWN FRAMED BY AN HERBACEOUS BORDER

Japanese privet is especially suitable for the hedge, and low herbaceous plants should be used in the border

should be well watered after being set. Several plants of each kind should be grouped in order to create a massed effect and so that there will be well-balanced bloom in all parts of the garden continuously.

WINTER PROTECTION

On a dry day soon after the first killing frost in the fall, bulbous and cormous plants, such as the dahlia and the gladiolus, should be lifted. The stems should be cut, leaving about three or four inches attached to

the tubers. The tubers should be left on the ground to dry for a few hours, and should then be stored in a cool, dry cellar, where the temperature will not drop below 40° F. during the winter months. The decaying stems and leaves of the perennials should be removed and burned before the material used for winter protection is placed on the plants. The use of the stems and foliage of the plants for winter protection is to be condemned, as oftentimes they harbor the dormant spores of plant diseases over winter. Strawy manure, cheap hay, or leaves of trees furnish the best winter protection for the flower garden. This material should be placed over the border to a depth of from two to three inches. Care should be exercised, however, in placing a covering over such plants as foxgloves or sweet williams, as their foliage is retained thruout the winter, and if too heavy a dressing is applied over them, it has a tendency to cause the leaves and crowns of the plants to decay.

ANNUALS

In order to be grown to perfection, annuals require much more careful cultivation than is generally given. Far too often all the cultivation that is bestowed on them is to scratch the surface of a particularly shaded bed or border and sow them in patches, where, if they escape being devoured by cutworms and snails, they are left unthinned and uncared for, and the result is a weak, sickly, and short-lived crop of bloom.

The most suitable soil for annuals is sandy loam, deeply worked and moderately enriched with manure. Deep tillage is of first importance; and where annuals are sown among herbaceous plants, as is very general, it is hopeless to expect them to do well if the treatment is merely superficial. The surface of the soil should be made fine and level before the seeds are sown.

As a general rule, except in the case of sweet peas, the end of April or the beginning of May is early enough to sow the hardy annuals. The more tender kinds may be started in coldframes or in flats in the dwelling house, and the seedlings transplanted to the garden when all danger of severe frost is past. Small seeds should be just covered with soil and no more; larger ones may be covered an inch.

Thinning annuals is important, and, as a rule, is given little attention. The neglect of it does more to injure them than anything else. Two or three thinnings are recommended, beginning as soon as the plants can be easily handled. The amount of thinning varies with the habit of growth of the plants; larkspurs, for instance, do not require so much thinning as plants of a more spreading or branching habit. All annuals should be thinned, however, so that each plant can develop properly.

The season of bloom of annuals may be materially prolonged by removing all withered blossoms and so preventing the formation of seed pods. When annuals are watered, the ground should be thoroly soaked, not just moistened on the surface.

Some annuals require staking, and this should be done before the plants become full grown. It is a common and unsightly practice to tie annuals bundlelike to a stake after they are fully developed. Annuals in beds should have some twiggy branches, such as birch or beech, put among them; the growth will ultimately hide the supports.

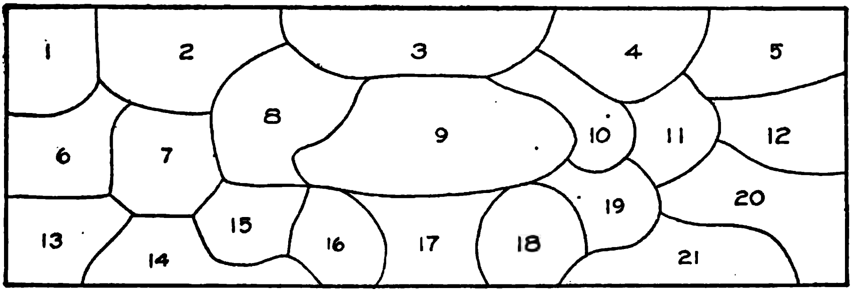

FIG. 33. PLAN FOR A HARDY PERENNIAL FLOWER BORDER FIFTY BY NINE FEET

1. *Rodgersia podophylla*, white flowers, bronze foliage
2. *Delphinium hybridum*, variety Lizzie, azure blue
3. *Bocconia cordata*, white flowers, green foliage
4. *Helenium autumnale*, gold
5. *Aster novæ-angliæ*, bluish purple
6. *Echinops ritro*, blue
7. *Iris flavescens*, soft yellow
8. *Kniphofia uvaria*, variety Lemon Queen, lemon-yellow
9. *Phlox paniculata*, variety Coquelicot, scarlet
10. *Aquilegia chrysantha*, pale yellow
11. *Pentstemon barbatus* var. *torreyi*, scarlet
12. *Anemone japonica*, variety Whirlwind, white
13. *Heuchera sanguinea*, scarlet
14. *Œnothera fruticosa*, yellow
15. *Incarvillea delavayi*, pink
16. *Platycodon grandiflorum* var. *mariesii*, white
17. *Dianthus plumarius*, pink
18. *Trollius asiaticus*, orange-yellow
19. *Statice latifolia*, lavender
20. *Campanula medium*, pink
21. *Viola cornuta*, variety Ardwell Gem, yellow

Among the most useful of the annual flowers are China aster, pansy, phlox, cosmos, sweet alyssum, petunia, verbena, marigold, snapdragon, bachelor's-button, zinnia, sweet scabios, nasturtium, and larkspur.

ARRANGEMENT OF COLORS

The art of color arrangement in a garden consists in so placing plants as to produce harmony or contrast in color both in foliage and in flowers. A particularly pleasing color effect was carried out in the herbaceous garden illustrated on page 74. Pale blue perennial larkspurs were planted next to the pale pink rose Tausendschön. Harmonizing colors in general are more pleasing than those which contrast. For example, if a golden-leafed plant, such as golden feather (*Chrysanthemum parthenium* var. *aureum*), is associated with some of the silvery foliaged plants, such as dusty miller (*Senecio cineraria*) or snow in summer (*Cerastium tomen-*

tosum), a most delicate and pleasing harmony is produced; if yellow day lilies (*Hemerocallis flava*) are planted near a crimson rambler rose the contrast is harsh and anything but pleasing. Harmony and contrast however may be illustrated with good effect in one bed. The center of the bed may be yellow with a zone of white surrounded by an outer zone of blue or purple. The yellow and white harmonize, while the blue or the purple furnishes the contrasting color. In formal gardening, harmonizing colors should be given a position in the center of the bed, and the contrasting colors placed around the margin. This principle is

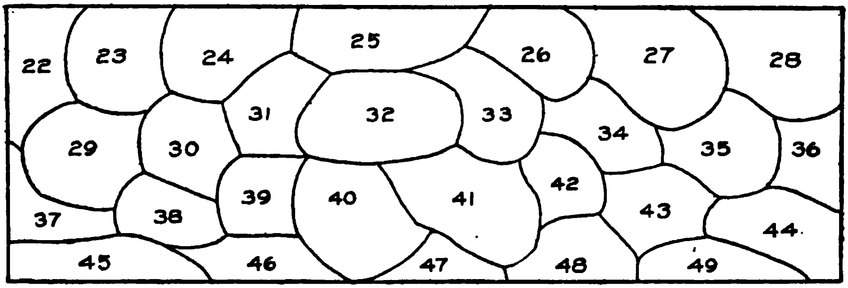

FIG. 34. PLAN FOR A HARDY PERENNIAL FLOWER BORDER FIFTY BY NINE FEET

This plan may be used with the one on page 86 for a long border, or the two may be arranged on opposite sides of a grass or gravel walk six feet wide

22. *Lupinus polyphyllus* var. *roseus*, pink
23. *Aconitum napellus*, blue
24. *Helianthus decapetalus* var. *multiflorus*, orange-yellow
25. *Digitalis purpurea*, variety Sutton's Primrose, primrose yellow
26. *Althæa rosea* var. *flore albo pleno*, white
27. *Dictamnus fraxinella*, red-carmine
28. *Aconitum autumnale*, violet-blue
29. *Aquilegia chrysantha*, primrose yellow
30. *Anemone japonica* var. *elegans*, delicate flesh color
31. *Helenium autumnale*, variety Riverton Gem, old gold changing to bronze
32. *Aster amellus*, variety Beauty of Colwall, lilac-blue
33. *Coreopsis lanceolata* var. *grandiflora*, golden yellow
34. *Phlox paniculata*, variety Miss Oliver, pale pink
35. *Aster acris*, lavender
36. *Iris flavescens*, lemon-yellow
37. *Statice latifolia*, lavender-blue
38. *Heuchera sanguinea* var. *splendens*, crimson
39. *Chrysanthemum hybridum*, variety Soeur Melaine, white
40. *Kniphofia uvaria*, variety Lemon Queen, lemon-yellow
41. *Trollius europæus* var. *grandiflorus*, cream yellow
42. *Iris pallida* var. *dalmatica*, lilac
43. *Hemerocallis flava*, yellow
44. *Monarda didyma*, crimson
45. *Viola cornuta*, variety Primrose Yellow, yellow
46. *Chrysanthemum hybridum*, variety Brown Bessie, apricot
47. *Polemonium cæruleum*, sky blue
48. *Dicentra spectabilis*, rose-white
49. *Platycodon grandiflorum* var. *album*, white

particularly applicable to the isolated bed, because the eye comprehends and groups the arrangement better with the soft color in the center than at the margin.

The following table of colors and their contrasts will be helpful when studying arrangement of color in the flower garden:

Black	white	Green	red-violet
Red	green	Indigo	orange-yellow
Orange	blue	Violet	blue-green
Yellow	indigo		

The nearest approach to black is supplied by foliage plants, such as *Perilla nankinensis*, coleus, ornamental beets, cannas, and a few others. The colors of these plants may be described as red-black; the contrasting colors therefore would be green-white, which could be supplied by using plants with variegated green and white foliage, such as the geraniums (Pelargoniums), funkias (*Hosta lancifolia*, var. *albo marginata*), and others.

When laying out a garden and studying its color composition it is well to remember that blue is the coldest and most retiring of colors, and that its complementary, orange, is the warmest and most advancing.

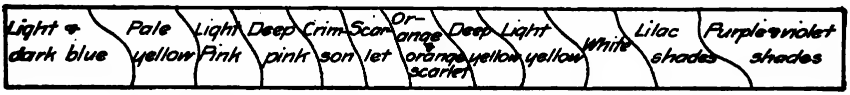

FIG. 35. A COLOR SCHEME FOR THE HERBACEOUS BORDER

The more pleasing results are obtained by placing plants bearing the softer and more delicate colors and foliage near the dwelling house, and by using the warmer colors, such as scarlet, crimson, orange, and yellow, a distance away in the border. These brighter colors should have a liberal background of rich, deep green foliage. For the most satisfactory results in border planting it is best to mass each color. This method will give dignity to the flower garden. Care must be exercised, however, that the color masses are never so large as to become monotonous. After a definite color scheme has been chosen, the plants having flowers of approximately the same color may be grouped together to follow each other in season of blooming. Thus, in a section of the border devoted to red, tulips, oriental poppies, montbretias, torch lilies, and gladiolus will produce a succession of scarlet flowers thruout the season.

HERBACEOUS PERENNIALS FOR THE HOME FLOWER GARDEN

HARDY HERBACEOUS PLANTS WITH PINK OR ROSE-COLORED FLOWERS

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Hollyhock (*Althæa rosea*)			July–September	Seeds	Stately hardy plant
Newport Pink	Clear pink	6–8			
Japanese Windflower (*Anemone japonica*)			August–September	Division; root cuttings	Important hardy plant; flowers excellent for cutting
Alice	Silvery rose	2–3			
Kriemhilde	Rose-pink	2–3			
Queen Charlotte	Delicate pink	2–3			
Michaelmas Daisy			September–October	Division; cuttings	Among the showiest of the late-flowering hardy plants
Lil Fardell (*Aster novæ-angliæ*)	Rose-pink	5			
Perry's Favorite (*Aster amellus*)	Clear rose	2			
St. Egwin (*Aster novi-belgii*)	Bright pink	2½–3			
David's Spiræa (*Astilbe davidii*)	Rich rose-pink	3–4	July–August	Division	Stately hardy plant; succeeds best in a medium heavy moist soil
Perennial Cornflower (*Centaurea montana* var. *carnea*)	Flesh pink	2	June–August	Division	Fine border plant; flowers excellent for cutting
Border Chrysanthemum (*Chrysanthemum hortorum*)			September–October	Division; cuttings	Popular border plant; useful for cut flowers
Old Homestead	Pink	2½			
Minta	Delicate pink	2½			
Nio	Shell pink	2½			
Lilian Doty	Pink	2½			
St. Illoria	Silvery rose	2½			
Sweet William (*Dianthus barbatus*)			June	Seed	A biennial that is effective for beds and borders
Newport Pink	Pink	1½			

HARDY HERBACEOUS PLANTS WITH PINK OR ROSE-COLORED FLOWERS (*concluded*)

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Goat's Rue (*Galega officinalis* var. *carnea*)	Rose-pink	3–4	June–August	Division	Good foliage; perennial; useful for cutting
Cranesbill (*Geranium endressii*)	Bright rose	1½–2	June–July	Division	Exceedingly pretty; will thrive in any position in the garden
Hybrid Gladiolus (*Gladiolus* sp.)	Numerous shades of pink	2½–4	July–September	Cormels	Popular for border planting and for cutting
Alum Root or Coral Bell (*Heuchera sanguinea*) Edge Hill	Rose	2	June–August	Division	Excellent for border or rockery or for cutting
Hardy Gloxinia (*Incarvillea delavayi*)	Rose	2½	September–October	Root cuttings	Choice perennial plant with showy gloxinia-like flowers
Everlasting Pea (*Lathyrus latifolius*)	Rose	6	July–September	Seed or division	Showy climber useful for covering old stumps or fences
Japanese Lily (*Lilium speciosum* var. *magnificum*)	Ruby rose	3–3½	August–September	Offsets from bulbs	An excellent plant when massed
Loosestrife (*Lythrum salicaria* var. *roseum*)	Rose-pink	4	July–August	Division	Useful for massing on the sides of a stream or a pond
Mallow (*Malva moschata*)	Rose-purple	2–3	June–July	Division	Desirable plants seen at their best when grown in damp places

Hardy Phlox (*Phlox paniculata*)			August–October	Division; cuttings	One of the most useful perennials for flower-bed and border planting
Elizabeth Campbell	Salmon-pink	2–2½			
Gefion	Light pink	2–2½			
Rheinlander	Salmon	2–2½			
Thor	Deep salmon-pink	2–2½			
W. C. Egan	Soft pink	2–2½			
Bouncing Bet (*Saponaria officinalis* var. *roseoplena*)	Rose-pink	2½–3	July–September	Division	Showy plant for the border
Lister's Mallow (*Sidalcea malvaeflora* var. *listeri*)	Satiny pink	3	July–August	Division	Easily grown in border soil in any position
Stonecrop			August–September	Division	Plants form flattish corymbs of pink and rose-colored flowers
(*Sedum sieboldii*)	Bright pink	1			
(*Sedum spectabile*)	Rose-pink	3			

HARDY HERBACEOUS PLANTS WITH RED OR CRIMSON FLOWERS

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Hollyhock (*Althæa rosea*)	Crimson	6–8	July–September	Seed	
Japanese Windflower (*Anemone japonica*)			August–September	Division; root cuttings	A genus of plants rich in beauty and variety
Prince Henry	Rosy crimson	2			
Michaelmas Daisy (*Aster amellus*)			September–October	Division	
Mrs. J. F. Rayner	Crimson	5			
Hardy Chrysanthemum (*Chrysanthemum hortorum*)			September–October	Division	
Autumn Glow	Rose-crimson	3			

HARDY HERBACEOUS PLANTS WITH RED OR CRIMSON FLOWERS *(concluded)*

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Scarlet Larkspur (*Delphinium cardinale*)	Bright scarlet	3	July–August	Division; seed	Excellent for use near the front of the border
Gas Plant (*Dictamnus fraxinella*)	Purple-red	2	June–August	Division of fleshy roots; seed	Old-fashioned perennial; does well in sun or shade
Gladiolus (*Gladiolus* sp.)	Many shades with red grounds	3–5	July–September	Offsets from corms	Most attractive and useful of all summer-flowering bulbs; exceedingly popular as a fall cut flower
Sneezeweed (*Helenium autumnale* var. *rubrum*)	Crimson and gold	4	August–September	Division	Desirable border plant for a sunny situation
Alum Root (*Heuchera sanguinea* var. *splendens*)	Crimson	2	June–August	Division	Valuable for grace and ornament
Red-Hot Poker, Torch Lily (*Kniphofia uvaria* var. *pfitzeri*) Victor Lemoine	Orange-scarlet Bright red	3–4 4	August–October August–September	Division	Among the stateliest of perennials; unequaled for ornamental value
Swamp Lily (*Lilium superbum*)	Orange-crimson	5	July–August	Offsets from bulbs	A beautiful native lily
Tiger Lily (*Lilium tigrinum* var. *splendens*)	Rich orange-red, spotted blade	4	August–September	Offsets from bulbs	Beautiful for massing where orange-red effects are required
Jerusalem Cross (*Lychnis chalcedonica*)	Scarlet	3	July–August	Seed	Thrives in any soil; a most desirable plant

Beard Tongue (*Pentstemon barbatus*)	Coral red	3	July–August	Division	A most decorative species
Hardy Phlox (*Phlox paniculata*) Coquelicot G. A. Strohlein	 Orange-scarlet Orange-scarlet	 3 3½	August–October	Division; cuttings	

HARDY HERBACEOUS PLANTS WITH BLUE FLOWERS

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Monkshood (*Aconitum autumnale*) (*Aconitum napellus*)	 Violet-blue Dark blue	 5 3–5	September–October	Division	Roots are poisonous; this plant should not be allowed in children's gardens
Alkanet (*Anchusa italica*) Dropmore	 Gentian blue	 4–5	June–August	Root cuttings	Desirable plant for the border
Michaelmas Daisy (*Aster acris*) (*Aster amellus* var. *bessarabicus*) Beauty of Colwall (*Aster novi-belgii*) Ryecroft Purple (*Aster novæ-angliæ*)	 Lavender-blue Deep violet Lilac-blue Blue-purple	 2–2½ 1½–2 4–5 4½	August–September	Division; cuttings	Useful plants for fall-flowering effects in the herbaceous garden
Bellflower (*Campanula persicifolia*)	Soft blue	2–3	May–June	Seed	Prefers deep well-enriched soil
Perennial Cornflower (*Centaurea montana*)	Violet	2	June–September	Division	Excellent for cutting
Globe Thistle (*Echinops ritro*)	Steel blue	3	August–September	Division	Both picturesque and ornamental

HARDY HERBACEOUS PLANTS WITH BLUE FLOWERS (*concluded*)

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Gladiolus (*Gladiolus* sp.) Blue Jay	Purple	3	July–August	Offsets from corms	
Japanese Iris (*Iris laevigata*)	Blue to purple	$2\frac{1}{2}$	June–August	Seed; division	This attractive type of iris is particularly useful for planting on the edges of ponds or streams
Hardy Phlox (*Phlox paniculata*)	Violet, purple, and blue shades	$3\frac{1}{2}$	August–September	Division; cuttings	
Balloonflower (*Platycodon grandiflorum* var. *mariesii*)	Deep blue	1	July–August	Division	Handsome late-summer and autumn-flowering perennial
Hardy Scabious (*Scabiosa caucasica*)	Lilac-blue	2–3	June–August	Division	Especially good as a cut flower
Sea Lavender (*Statice latifolia*)	Lavender-blue	$2–2\frac{1}{2}$	June–August	Division	One of the best fall-flowering perennials
Speedwell					Vigorous, showy, free-blooming
(*Veronica longifolia*)	Purplish blue	2–3	July–September	Division	
(*Veronica spicata*)	Bluish violet	1	June–August	Division	
(*Veronica subsessilis*)	Royal purple	2–3	August–September	Division	
Tufted Pansy (*Viola cornuta*)			April–September	Division; cuttings	Popular and most useful for effects in front of border
Bridal Morn	Heliotrope-blue	$\frac{1}{2}$			
Papilio	Violet	$\frac{1}{2}$			
Admiration	Purple	$\frac{1}{2}$			

HARDY HERBACEOUS PLANTS WITH WHITE FLOWERS

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Sneezewort (*Achillea ptarmica*) The Pearl	Papery white	2	July–August	Division	Good for garden adornment or for cutting
Hollyhock (*Althæa rosea*)	Papery white	6–8	July–September	Seed; division	Attractive for background effects
Japanese Windflower (*Anemone japonica*) Whirlwind	Pure white	2–3	August–September	Division; root cuttings	Important hardy plant; also useful for cutting
Columbine (*Aquilegia vulgaris* var. *alba*)	Pure white	2–3	June–July	Seed; division	Excellent for flowers and foliage effects
Michaelmas Daisy (*Aster ericoides*) White Queen Snowflake	 Pure white Pure white	 3½ 1½	October	Division; cuttings	Among the showiest of the late-flowering hardy plants
Plume Poppy (*Bocconia cordata*)	White	6–8	July–August	Division; seed	A stately hardy perennial; beautiful foliage
False Chamomile (*Boltonia asteroides*)	White	5–7	July–September	Seed; division	Showy native perennial with aster-like flowers
Carpathian Harebell (*Campanula carpatica* var. *alba*)	Pure white	¾	June–October	Seed; division	Excellent as edging for hardy border
Chimney Bellflower (*Campanula pyramidalis* var. *alba*)	White	4–6	August	Seed	Very attractive pyramidal bellflower
Hardy Chrysanthemum (*Chrysanthemum hortorum*) Soeur Melaine The Hub	 White White	 2½–3 2½–3	September–October	Division; cuttings	Popular plant for the hardy border

HARDY HERBACEOUS PLANTS WITH WHITE FLOWERS (*concluded*)

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Shasta Daisy (*Chrysanthemum maximum*)			August–September	Division; seed	The flowers of this species are very large and attractive
Alaska	Glistening white	1½			
Snakeroot (*Cimicifuga racemosa*)	Pure white	4–6	July–August	Division; seed	Handsome native plant suited for use at back of border
Larkspur (*Delphinium grandiflorum* var. *album*)	Satiny white	3–4	July–August	Division; seed	A new acquisition to the flower border
Moerheimi	Pure white	5	June–September		
Gas Plant (*Dictamnus fraxinella* var. *alba*)	White	2	June–August	Division; seed	Showy border perennial
Foxglove (*Digitalis purpurea* var. *alba*)	White spotted	4–5	June–July	Seed	A valuable plant both in a sunny position and in partial shade
White Snakeroot (*Eupatorium urticæfolium*)	Pure white	3–3½	August–September	Division	Attractive as a foliage perennial
Goat's Rue (*Galega officinalis* var. *alba*	White	3–4	June–August	Division	
Spire Lily (*Galtonia candicans*)	White	3–4	August–September	Division of bulbs	Tall spikes of drooping bell-shaped flowers
Gladiolus (*Gladiolus* sp.)	Various light shades	2–4	July–August	Cormels	
Baby's Breath or Chalk Plant (*Gypsophila paniculata*)	White	2–3	July–August	Division; seed	Will thrive in any soil in a sunny position

White Everlasting Pea (*Lathyrus latifolius* var. *albus*)	Pure white	5–6	July–September	Seed; division	Climber
Japanese Lily (*Lilium speciosum* var. *album*)	Snowy white	3–3½	August–September	Offsets from bulbs	
White Lupine (*Lupinus polyphyllus* var. *albiflorus*)	Delicate white	3	June–July	Division	Useful for garden decoration and for cutting
Wild Chamomile (*Matricaria inodora*)	Pure white	1½–2	July–October	Cuttings	Excellent for foliage effects
Iceland Poppy (*Papaver nudicaule* var. *album*)	Creamy white	1	May–August	Seed	Very good for the front of the border and for cutting
Hardy Phlox (*Phlox paniculata*) F. G. von Lassburg	Snow white	3½	August–October	Division; cuttings	
Balloonflower (*Platycodon grandiflorum* var. *album*)	Pure white	¾–1	July–August	Division	
Hardy Scabious (*Scabiosa caucasica* var. *alba*)	White	2–3	June–August	Division	
Dropwort (*Spiræa filipendula*)	Double white	1½	June–August	Division	
Speedwell (*Veronica virginica* var. *alba*)	White	2	July–August	Division	
Tufted Pansy (*Viola cornuta*) Snowflake	Snow white	½	April–September	Division; cuttings	

HARDY HERBACEOUS PLANTS WITH YELLOW AND ORANGE-COLORED FLOWERS

Name	Color	Height in feet	Period of bloom	How propagated	Remarks
Golden Yarrow (*Achillea filipendulina*)	Golden yellow	3–4	July–September	Division	
Hollyhock (*Althæa rosea*)	Pale yellow	6–8	July–September	Seed	
Knapweed (*Centaurea macrocephala*)	Golden yellow	2½–3	July–September	Division	
Chrysanthemum (*Chrysanthemum hortorum*)			September–October	Division	
Michael	Lemon-yellow	1½			
Sunshine	Golden yellow	1½			
Globe d'Or	Lemon-yellow with darker shadings	1¼			
Gladiolus (*Gladiolus* sp.)	Various shades of yellow	3	July–September	Offsets from corms	
Sneezeweed				Division	Indispensable where yellow effects are desired in the border
(*Helenium autumnale*)	Clear yellow	6	August–September		
(*Helenium hoopesii*)	Orange-yellow	1½	June–July		
Riverton Beauty	Lemon-yellow with purplish black cone	4	August–September		
Hardy Sunflower				Division	Valuable for background effects in the yellow section of the border
(*Helianthus mollis*)	Lemon-yellow	4	August–September		
(*Helianthus multiflorus* var. *maximum*)	Golden yellow	5–6	July–August		
Day Lily (*Hemerocallis aurantiaca* var. *major*)	Orange-yellow	2	July–September	Division	Attractive foliage and flowers

Red-Hot Poker (*Kniphofia uvaria*) Lemon Queen	Lemon-yellow	3	August–September	Division	
Evening Primrose (*Œnothera fruticosa*)	Golden yellow	1½–2	July–September	Seed	
Iceland Poppy (*Papaver nudicaule*)	Bright yellow	1	June–September	Seed	
Coneflower, Golden Glow (*Rudbeckia laciniata*) (*Rudbeckia speciosa*)	Yellow Dark orange-yellow	5 3	August–September July–September	Division	Very attractive summer-blooming perennials of easy cultivation
Goldenrod (*Solidago canadensis*)	Bright yellow	5	August–September	Division	
Montbretia (*Tritonia crocosmæflora*)	Various shades of yellow	2	July–August	Offsets	Bulbs should be lifted in the fall and replanted in the spring
Tufted Pansy (*Viola cornuta*) Golden Sovereign	Golden yellow	½	April–September	Division; cuttings	

DESIRABLE PLANTS FOR SHADY OR SEMISHADY POSITITIONS[1]

Monkshood (*Aconitum napellus; A. napellus* var. *bicolor; A. fischeri*)
Baneberry (*Actæa spicata*)
Windflower (*Anemone pennsylvanica*)
Lily of the Valley (*Convallaria majalis*)
Bleeding Heart (*Dicentra spectabilis*)
Plaintain Lily (*Hosta* [=*Funkia*] *plantaginea; H. cærulea; H. lancifolia* var. *alba-marginata*)
Liverleaf (*Hepatica triloba; H. acutiloba*)
Meadow Rue (*Thalictrum aquilegifolium; T. minus* var. *adiantifolium*)
Wake-robin (*Trillium erectum; T. grandiflorum*)
Virginian Cowslip (*Mertensia virginica*)

PLANTS SPECIALLY RECOMMENDED FOR DRY SOILS[1]

Butterfly Weed (*Asclepias tuberosa*)
Columbine (*Aquilegia alpina; A. canadensis*)
Baby's Breath (*Gypsophila acutifolia; G. paniculata*)
Blanket Flower (*Gail ardia grandiflora*)
Cranesbill (*Geranium sanguineum*)
Double Hardy Sunflower (*Helianthus decapetalus* var. *multiflorus*)
Inula (*Inula grandiflora; I. ensifolia*)
Rockfoil (*Saxifraga crassifolia*)
Stonecrop (*Sedum acre; S. sieboldii; S. stoloniferum*)
Tunica (*Tunica saxifraga*)

PLANTS RECOMMENDED FOR WET SOILS[1]

Swamp Mallow (*Hibiscus moscheutos*) and all the mallows
Iris (*Iris pseudacorus; I. sibirica; I. lævigata* [=*I. kæmpferi*] *I. prismatica; I. versicolor*)
American Turk's-Cap Lily (*Lilium superbum*)
Cardinal Flower (*Lobelia cardinalis*)
Bee Balm, Oswego Tea (*Monarda didyma*)
Purple Loosestrife (*Lythrum salicaria*)
Moneywort (*Lysimachia nummularia; L. clethroides*)
Knotweed (*Polygonum sieboldii* [=*P. cuspidatum*])
Spiræa (*Astilbe japonica* and varieties)

TWELVE OF THE MOST USEFUL AND MORE COMMONLY GROWN HARDY PERENNIALS

Japanese Windflower (*Anemone japonica*)
Hollyhock (*Althæa rosea*)
Larkspur (*Delphinium hybridum*)
Peony (*Pæonia albiflora*, early flowering)
Iris (*Iris germanica*, early flowering; *I. lævigata*, late flowering)
Phlox (*Phlox paniculata*)
Scotch Pink (*Dianthus plumarius*)
Bellflower (*Campanula persicifolia*)
Michaelmas Daisy (*Aster novæ-angliæ; A. novi-belgii*)
Columbine (*Aquilegia chrysantha*)
Golden Glow (*Rudbeckia laciniata*)
Balloonflower (*Platycodon grandiflorum*)

[1] This list includes spring-, summer-, and fall-flowering plants.

ADVANCED READING

Colour schemes for the flower garden. Gertrude Jekyll. Charles Scribner's Sons, New York City.

The well-considered garden. Mrs. Francis King. Charles Scribner's Sons, New York City.

The new gardening. Walter P. Wright. Doubleday, Page and Company, Garden City, Long Island, New York.

The principles of floriculture. E. A. White. The Macmillan Company, New York City.

The home grounds. E. G. Davis and R. W. Curtis. Cornell University Agricultural Experiment Station. Bulletin 361.

The surroundings of the farm home. E. Gorton Davis. Cornell Reading Course for the Farm. Lesson 96.

The culture of garden roses. A. C. Beal. Cornell Reading Course for the Farm. Lesson 121.

Gladiolus studies — II: culture and hybridization of the gladiolus. Alfred C. Hottes. Cornell Extension Bulletin 10.

Spring in the flower garden. David Lumsden. Cornell Reading Course for the Farm. Lesson 106.

Hotbeds and cold frames. A. E. Wilkinson. Cornell Reading Course for the Farm. Lesson 120.

READING COURSES IN VEGETABLE GARDENING

"Every one who creates a garden helps, and helps greatly, to solve the problem of the feeding of the nations."—PRESIDENT WILSON, April 15, 1917.

Home gardening furnishes an opportunity to do a number of things at one stroke, to conserve the health of the family and add to its enjoyment, to reduce living expenses, and to increase the food supply. Gardening is patriotism in action. Vegetables may be grown in dooryards, on vacant lots, and on the farm with little expense, and a large amount of food may be produced in even a small garden if it is properly handled. Reliable information on gardening may make the difference between success and failure. Gardeners who obtain the best results will be those who have made a study of vegetable growing. The following publications may be obtained free on request: *The Home Vegetable Garden; Hotbeds and Cold Frames; Planting the Home Vegetable Garden; Summer Care of the Home Vegetable Garden; Control of Vegetable Diseases.*

The Advanced Reading Course in Vegetable Gardening is a correspondence course intended to meet the need for more complete information. It comprises sixty-one lessons in a textbook; thirty-six of these lessons are brief, complete discussions on as many different vegetables, making the course thoro and practical. These lessons are supplemented by twenty-two practical exercises in order to promote first-hand knowledge of soils, fertilizers, plant life, garden tools, and city markets, and in order to give experience in testing seeds, sowing, transplanting, and care of the garden. The work of each student receives careful attention by a member of the college staff. Each report is corrected, graded, and returned with criticisms and suggestions. The only expense is the cost of the textbook, which is not published by the College of Agriculture, and of materials for the practical exercises. Each student is encouraged to operate a garden and is assisted in making the local application of the principles and practices discussed.

THE CORNELL READING COURSE FOR THE FARM

Residents of New York State may register without charge for one or more of the following series in the reading course. Each of the reading course lessons is available for distribution on request.

SERIES LESSONS

THE SOIL

74 Introduction to the principles of soil fertility
42 Tilth and tillage of the soil
50 Nature, effects, and maintenance of humus in the soil
70 Soil moisture and crop production
78 Land drainage and soil efficiency
127 Farm manure: its production, conservation, and use

FARM CROPS

66 Meadows in New York
90 Alfalfa for New York
108 Culture of sweet clover and vetch
110 Buckwheat
112 Potato growing in New York
124 Field bean production

LIVESTOCK

114 Silos, and the production and feeding of silage
115 Keeping sheep for profit
116 The dairy herd
117 Computing rations for farm animals
119 The curing of meat and meat products on the farm
126 Swine production in New York

DAIRYING

86 The production of clean milk
102 Cooling milk
82 Cream separation
32 Composition of milk and some of its products
60 Farm butter-making
98 Practical examples in dairy arithmetic
118 The Babcock test, and testing problems

FARM FORESTRY

12 The improvement of the woodlot
62 Methods of determining the value of timber in the farm woodlot
28 Recent New York State Laws giving relief from taxation on lands used for forestry purposes
40 County, town, and village forests

SERIES	LESSONS
FRUIT GROWING	
125	Orchard soil management
104	Pruning
84	Insects injurious to the fruit of the apple
123	Top-working and bridge-grafting fruit trees
36	Culture of red and black raspberries and of purple-cane varieties
48	Culture of the cherry
52	Culture of the blackberry
72	Culture of the grape
PLANT BREEDING	
38	Principles and methods of plant breeding
44	Methods of breeding oats
68	Improving the potato crop by selection
129	Improving the corn crop by selection and breeding
THE HORSE	
46	Feeding and care of the horse
56	Practical horse breeding
113	Judging draft horses
POULTRY	
80	Incubation
88	Feeding young chickens
353	The interior quality of market eggs
VEGETABLE GARDENING	
120	Hotbeds and cold frames
122	Planting the home vegetable garden
92	Summer care of the home vegetable garden
FLOWER GROWING	
106	Spring in the flower garden
128	Autumn in the flower garden
121	The culture of garden roses
COUNTRY LIFE	
64	The rural school and the community
76	Birds in their relation to agriculture in New York State
94	The farm fishpond
96	The surroundings of the farm home
59	Sewage disposal for country homes

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 128 FLOWER GROWING SERIES SEPTEMBER, 1917

AUTUMN IN THE FLOWER GARDEN

DISCUSSION PAPER

The discussion paper takes the place of the teacher in encouraging thought and self-expression on important points in the lesson, and in giving an opportunity for questions by the reader. Each discussion paper filled out and returned is read carefully, and a personal reply is made to questions on any agricultural subject. In order to continue a course, the reader should sign and return the discussion paper so that another lesson may be sent. Questions are included on the discussion paper for the purpose of assisting those readers who desire to give the lesson special study. Preparing the answers is optional.

The available reading course lessons for the farm are arranged in series on the following subjects: THE SOIL, FARM CROPS, LIVESTOCK, DAIRYING, FARM FORESTRY, FRUIT GROWING, PLANT BREEDING, THE HORSE, POULTRY, VEGETABLE GARDENING, FLOWER GROWING, COUNTRY LIFE. New readers may enroll in one or more of these subjects. The first lesson in the series is sent on enrollment, and subsequent lessons are sent, one at a time, on the return of discussion papers. The reader may register for the Flower Growing Series by signing and returning this discussion paper. The space below on this page is reserved for registration in other series, and also for names and addresses of residents of New York State likely to become interested in the reading course.

(*Detach, sign, and return for the next lesson in this series.*)

(In answering questions, attach additional paper if needed and number the answers.)

1. How should the soil be prepared for hardy herbaceous perennials?

2. What are the four methods of propagation of perennials? State the merits of each method.

3. Where should hardy perennials be placed in the home grounds to create the best effects?

4. Which are the best months of the year to plant or transplant hardy perennials?

5. Have you planted perennials in the fall? If so, give your experience.

6. What has been your experience in reference to the wintering over of perennial plants? What material have you found best to use for winter protection?

7. Give your cultural methods and experience in growing dahlias. What types of dahlias do you grow?

8. State your experience with annual flowers. Which do you consider most useful to grow?

9. What is meant by harmonizing colors? Give an example in plant materials.

10. From an aesthetic standpoint, how are the most pleasing results obtained in the arrangement of plant material?

Name...

Address...

Date...

(Address all correspondence to the Reading Course for the Farm, College of Agriculture, Ithaca, New York.)

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
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LESSON 129 PLANT BREEDING SERIES OCTOBER, 1917

IMPROVING THE CORN CROP BY SELECTION AND BREEDING

FRANK P. BUSSELL

VARIETY WEBBER'S EARLY DENT

Published and distributed in futherance of the purposes provided for in the
Act of Congress of May 8, 1914

THE CORNELL READING COURSE FOR THE FARM

" Upon the farmers of this country in large measure rests the fate of the war and of the nations."— President Wilson, April 15, 1917

Under war conditions the skillful work of the man on the land has become more important than ever before. There is indeed every reason for zeal in increasing food production. Knowledge will help to make labor productive. Abraham Lincoln once said, " No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought, as agriculture." The College of Agriculture, thru the Reading Course for the Farm, offers twelve series of lessons for home study free to residents of New York State. The attached discussion paper gives details about these series.

The reading course lessons are elementary and brief. Three advanced reading courses, in farm crops, fruit growing, and vegetable gardening, provide more complete instruction in accordance with modern correspondence methods. Each student provides himself with a textbook and materials for practical exercises. Reports are prepared which are corrected, graded, and returned with criticisms and suggestions.

In a number of communities groups have organized for the discussion and study of common problems, and have adopted the name Cornell Study Club. The primary purpose of a Cornell study club is to furnish an occasion and an incentive for discussing reading course lessons for the farm and for the farm home, but the objects include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. Cornell study clubs are educational and social centers, and should develop local leadership and the human resources of the community. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College.

Correspondence is a medium for the exchange of helpful information. Letters will receive careful attention.

Royal Gilkey,
Supervisor of the Cornell Reading Course for the Farm.

IMPROVING THE CORN CROP BY SELECTION AND BREEDING

Frank P. Bussell [1]

THE corn plant is a factory. Its product is a quantity of grain, stover, or silage. Its efficiency in production depends on, first, the facility with which it obtains from soil and air its supplies of food and water, or in other words, soil fertility, cultivation, and climatic conditions; second, the proper balance and fine adjustment between the working parts or organs of the plant in receiving, elaborating, and storing as grain or stalk the raw materials received thruout the growing season. Inherited constitutional vigor, freedom from disease, and ability to concentrate all its energies on producing corn, make for efficiency of production. Economy in expenditure of effort is the meaning of efficiency; and viewing the corn plant as a corn producer, it is important that efficient individuals be chosen, just as it is important that high-producing dairy cows or labor-saving machinery be used.

WHAT IS A FIELD OF CORN?

The evidence for the view that an ordinary cornfield consists of more or less related individual plants, each differing from the other in its hereditary make-up, is not new; yet only in recent years has it been given practical consideration in seed selection. The whole field constitutes a mixture, a lot of individuals each varying from its neighbor in plant, ear, or kernel characters and, what is more important, in the hidden characters already enumerated, which, taken together, result in high or low yield, in efficiency or lack of efficiency.

Are there any marks on the corn plant, the ear, or the kernel that indicate whether the seeds will produce efficient plants the next season? For example, will the fine-appearing seed ear prove a better yielder than the less fancy one, provided both are equally sound? Will a thick stalk produce more corn than a thinner one of the same variety, a broad-leaved plant more than a narrow-leaved one, or a tall plant more than a shorter one?

[1] Other members of the staff of the Department of Plant Breeding gave helpful suggestions in the preparation of this lesson, and Professor C. H. Myers and W. I. Fisher assisted in preparing the illustrations.

HOW TO DISTINGUISH HIGH-YIELDING EARS OF CORN

High yield of sound corn is the ultimate thing wanted, and it would be a real help in corn improvement if some distinguishing marks could be found to aid in seed selection. In the days of the corn shows in the Middle West, it was commonly taught that good seed ears should be large, tapering to cylindrical in shape, well filled at tip and base, straight and many rowed, with deep, broad, wedge-shaped, closely packed kernels, small cob, and high percentage of corn per unit weight of ear. The results of much careful work show that there is no correlation within a variety between high yield and the shape or the size of ear used for seed. Within reasonable limits also no single plant nor ear character nor even combination of characters has yet been discovered that will prove an infallible guide in selection for yield. The characters enumerated indicate an excellent show ear but do not guarantee that the crop grown from its seeds will strongly resemble the parent ear in yield. This is true because of two considerations. First, the characters mentioned are very strongly influenced by growth conditions. Thus the filling of the ear at tip and base depends largely on the weather and the consequent condition of the silks and the tassel when the pollen begins or ceases to ripen. Second, the ear of corn is made up of many embryo plants, and pollen from different plants has fertilized them. The genetic make-up of the different grains varies, and " blood will tell " in corn as well as in men.

In view of these considerations the score card as a guide in selecting seed ears must be abandoned. The evidence justifies no one in attempting to improve yield merely by selecting any particular type of ear, and since this is so, what shall be the standard or the guide in making selection? What is the standard in animal breeding? Why does a well-bred dairy cow command a better price than a grade? Is it merely because her name appears in a registry list? Not at all. It is because her ancestry was such in performance that the chances of her being a superior animal are greater than is the case with the grade. Probable future worth based on past demonstrated worth is back of the fancy price. The grade animal may look as well as the pedigreed, but the chances of performance comparable with her looks are poorer. The well-bred cow is almost certain to have value as a dairy animal, the grade may or may not.

Choosing good, that is, high-yielding, ears of corn is therefore not so simple as it might seem. To be successful it involves selecting ears in accord with some scheme whereby the productive value of those chosen can be measured. The method by which this may be accomplished will be explained later in some detail. It is a method that will

give results if intelligently carried out, but it is neither expected nor desired that every farmer attempt to use it. It would, however, well repay at least one farmer in every township in all the corn-growing areas of the State to follow an intelligent system of corn breeding and furnish to the other growers of his locality the high-producing strains adapted to that locality. This method of procedure offers excellent opportunity not only for profit to the careful breeder, but also of materially increasing the yield per acre.

To the farmer who feels that he cannot undertake a breeding field but wishes to practice approved methods of selection, the following rules are

FIG. 36. A TEN-BUSHEL SAMPLE OF VARIETY CORNELL II

This strain was developed by ear-to-row breeding from variety Pride of the North. This corn was grown on the farm of E. W. Mosher, Aurora, Cayuga County

recommended. These are based not only on good theoretical considerations but on actual practice followed for some years by the writer with excellent results.

RULES FOR SELECTING SEED CORN

1. Select seed ears from vigorous plants. A well-formed ear on a weak plant may look better than a large ear on a vigorous plant, but it will hardly prove as productive in the next generation. Vigor and yield per plant are closely correlated.

2. Select only mature ears. Such ears are borne on plants acclimated and adjusted to their growth conditions. The temptation to pick immature ears because they are larger should be rigorously resisted. Maturity near

the close of the growing season is a good index of the ability of the plant to adjust itself. If two ears are on one stalk, the upper ear usually matures somewhat earlier than the lower, and seed from it may germinate better tho its hereditary make-up may be exactly similar to that of the lower ear.

3. Pick seed ears from standing stalks in the field, not from fodder shock or crib.

4. Use judgment in selecting for height of ear on stalk and angle of ear to stalk. Continued selection influences the height of ears, and selection for low ears decreases the height of the stalk. Low-borne ears usually mature somewhat earlier than those high on the stalk. The kernels on

FIG. 37. THE RESULT OF THREE YEARS SELECTION FOR YIELD AND EARLY MATURITY WITH VARIETY WEBBER'S EARLY DENT

The ears on the left are mature; those on the right are immature. The gain in earliness may be seen by comparing these piles of corn with those shown in figure 38. George R. Schauber, Ballston Lake, Saratoga County, was the cooperator

declining ears dry out better in wet fall weather and are less likely to rot than those on upright ears.

5. If corn is grown in hills, select seed ears only from hills having two or more stalks. This assures more even growth conditions and probably fuller cross-fertilization. In the case of drilled corn this of course does not apply, but selection should be made where the stand is complete.

6. Select from stalks bearing one large ear or from stalks with more than one ear growing on soil of medium or average fertility. The aim is to get corn suited to the average conditions of the farm, not to the richest corner of the best field.

Remember that good local adjustment is important. Adaptation for yield is a local matter and is largely dependent on continued selection

wherever a new sort is introduced into a locality. By selection, the corn plant is adapted to growth conditions, and when perfect adjustment is reached it is continued by heredity. In this way new and distinct strains may arise.

7. Pick seed corn early, before severe frosts damage its vitality. Sometimes the season for corn harvest is so unfavorable that it is difficult to obtain a supply of well-cured seed. A large supply of corn carefully selected and cured under very favorable conditions will retain its germinating and producing qualities unimpaired for several years. If properly stored, a supply of such corn on hand from year to year will be insurance against an unfavorable season. Dent corn has been kept for eight years at the

FIG. 38. THE RESULT OF NO SELECTION WITH VARIETY CORNELL 12

The mature ears are on the left; the immature ones on the right. This is the grain produced from a composite sample of the original ears from which the corn shown in figure 37 was developed

Cornell Agricultural Experiment Station with practically no loss of ability to germinate and to yield, but, of course, it was kept perfectly dry.

8. Dry the selected ears in a room or a building where air circulates freely and there is no dampness. The ears should be so hung that one does not touch another and allowed to remain until kernels and cobs are thoroly dry. They should then be stored in boxes or barrels where vermin cannot injure them. Low temperatures will not injure mature seed corn that has been hung up and properly dried immediately after picking.

9. Never buy seed corn except on the ear and then only from a reliable grower. If a neighbor has better corn, select seed from his field or buy of him. So far as is possible, buy only seed corn that is grown under soil and climatic conditions similar to those where it is to be planted.

10. Test the germination of each ear of corn before planting. This rule should be obeyed absolutely unless all the before-mentioned rules for picking, curing, and storing have been complied with.

REASONS FOR USING CARE IN SELECTING SEED CORN

It has been stated that these suggestions are based on good theoretical as well as practical considerations. The theoretical is but an attempt to explain the practical, and this leads to the extremely interesting field of heredity.

Vigor is an inherited thing. Vigorous children are usually the offspring of vigorous parents. Vigor means healthy and efficient interaction between all the parts and organs of the plant — roots, leaf, stalk, connecting tissue, shoot, tassel, and ear. Further it means adjustment to soil, air, and moisture conditions. Adjustment to one type of soil, to a given amount of moisture or sunshine, or to a given average of temperature is different from what must be made if the plant is to grow under a changed set of conditions. This point is very often overlooked by growers who buy seed corn from a distance. The highly pictured and extravagantly worded advertisements of the seed catalog hypnotize some farmers and put their judgment to sleep. The advertised corn may yield well in the locality to which it is adapted, but it may be entirely unable to rapidly adjust itself to a new locality. In view of these facts farmers are urged to choose and plant only varieties that have shown by actual performance in the neighborhood that they are vigorous growers and yielders. The farmer should let the corn breeder or the experiment station determine the worth of any advertised sort for his locality before he yields to the enticements of the catalog.

Only mature ears should be selected because big-eared, late-maturing sorts often produce less sound corn than smaller-eared, earlier sorts. The farmer must work with, not counter to, nature. The growing season is approximately fixed in length. The strain of corn that can manufacture and mature its product, giving the greatest weight of sound corn per acre, is the best sort to grow because it is worth the most. This may or may not apply to silage corn, but it does apply to all corn grown for yield of grain. It is no exaggeration to state that huge losses occur in this country because so many farmers attempt to grow sorts of corn adapted to a longer growing season than that of their locality. The corn situation in the fall of 1912 illustrates this. Millions of bushels of no-grade corn were marketed that fall by farmers in the Middle West. Only distillers and feeders could use this corn. With the present outlook for the distilled liquor industry the future market prospects for unsound corn are not bright.

Why select ears only from hills containing two or more stalks where the hill system is used? This question brings up the important consideration that corn is a hybrid plant. The silked ear is the female portion, the tassel and the pollen the male. In a field of corn, pollen from other tassels than the one on the stalk bearing the ear may fertilize the ear. It has been found that if the ear of a high-yielding plant be protected so that no pollen reaches it, and if it be carefully pollinated by hand with pollen produced by its own tassel, and if the same procedure be followed from generation to generation, the yield of grain will steadily decrease until in most cases

FIG. 39. HARVESTING A CORN BREEDING PLAT

The mature and the immature ears from the same row are kept in separate piles. This plat is on the farm of Seth Lowe, Bedford Hills, Westchester County, and G. D. Brill was the cooperator

it becomes very small. But if this be done with two or more plants and the silks of these low-yielding self-pollinated plants be cross-fertilized with pollen, each from the other plant, and plants from these cross-fertilized seeds be grown, the former ability to yield highly is immediately restored. Just why corn behaves thus is not known. Careful investigators are working on the problem, and further information is looked for.

The results of breeding tests indicate that in the living portions of the corn kernel are minute particles of germinal substance which give rise to the different plant characters. When the plant is continually fertilized with its own pollen, there is a sorting out of these particles so that each

kernel fails to receive the same kind of assortment of characters that it would receive if other pollen were used. This results, if continued for several generations, in a poor adjustment of working parts, or a lessened vigor of growth. The yield consequently suffers. In the long development that corn has undergone it has reached its high productivity because it has developed a machinery for cross-pollination. Inbreeding isolates definite characteristics hostile to its well being. A necessary cog in the machinery has dropped out here and there. When the seed is fertilized with pollen from another plant, the missing part is replaced. Probably the adaptation of the corn flowers to cross-fertilization has increased vigor, yield, and disease resistance, and enabled the corn plant to become adjusted to much wider regions for growth. Selection of ears from hills having several vigorous stalks, each with a good ear, is assurance of a high degree of cross-fertilization in the ear chosen and indicates vigor of the parent plant in competition with the other plants in the hill.

Seed corn should be bought only on the ear because the buyer can then apply a germination test and reject the poor ears. By noting the type of ear he can also form some idea whether the corn is likely to mature in his locality. Many seedsmen buy entire cribs of corn, shell, screen, and bag it, and sell it as choice seed with no selection whatever, tho some of the rotten ears may be discarded. The writer is personally acquainted with farmers who paid dearly for buying this sort of corn. It will be a long step in the right direction when farmers refuse absolutely to buy shelled corn for seed purposes. Even when seed corn is bought on the ear, a certificate showing where it was grown should be required. The especial advantage of buying seed on the ear is that it enables the farmer to test his corn and reject all ears of low vitality. Only corn that shows extra high vigor in the germination test should be planted. The Department of Plant Breeding of the College of Agriculture, Ithaca, New York, will furnish instructions for making such a test upon request of any corn grower interested.[2]

THE PROBLEM OF THE CORN BREEDER

In suggesting a plan for breeding corn it is not expected that every corn grower will attempt to breed corn. If he selects his own seed, he should follow the directions outlined for field selection and pay particular attention to maturity, drying and storing of seed, and germination tests. There should be, however, in every county or, better yet, in every township, at least one man who should operate a breeding field, testing by the ear-to-row method the individual ears of sorts that have yielded well in his locality.

[2] Directions for making germination tests of corn are also given in the following publications:
Seed corn. C. P. Hartley. U. S. Department of Agriculture. Farmers' Bulletin 415.
Seed testing. E. G. Montgomery. Cornell Extension Bulletin 26.

He should be willing to put some time and thoughtful effort into the work, and he may be assured that as soon as he is able to produce a superior strain of corn he will find a ready market for seed in his county at remunerative prices. He will probably find the demand so great that he will be tempted to lower his standards of selection. It is with the hope of interesting a few men in every county that a simple scheme of operating a breeding field is outlined in this lesson.

It has been already pointed out that a cornfield is made up of a number of individual plants having certain differences and certain likenesses in common. For example, all the plants grown from seeds on the same parent ear are full or half sister plants, depending on the source of the pollen used in fertilization. These all have certain common characteristics and may be so grouped as to produce plants yielding on the average either above or below the average of the whole field. There are no definite visible characters, however, by which only the ears that belong to the high-yielding type may be picked out. Careful selection of good ears from good vigorous plants is of great service of course, but the ear-to-row breeding test is the only known way to actually isolate and multiply the high-yielding strains present in a field. By this method the ability of each ear tested to produce corn is measured against the ability of every other ear similarly tested. Choice is then possible on the basis of actual performance.

The task for the corn breeder, therefore, is to separate the high-yielding from the medium- and low-yielding strains, and to bring the best of these together in a breeding field, where, by crossing the plants with each other, they may reach their highest possible efficiency. In the method here suggested, the aim is to reduce the labor involved to a minimum, but the corn breeder must make up his mind to take some pains to achieve success. He should consider corn breeding worthy of his best effort and should not become discouraged because results do not come at once. He is working with wonderfully complex and highly specialized living material. He is seeking light on one of the fundamental mysteries, the phenomenon of growth. Careful effort will yield not only ultimate crop improvement, but to the intelligent observer should prove an educational exercise of real value. He should be sure that the variety he proposes to test is locally well adjusted to both the soil and the growth conditions of the community. In general, the more carefully a variety is bred to meet the soil and climatic requirements of the locality, the better it will yield.

A METHOD OF CONDUCTING A CORN-BREEDING PLAT

In the fall prior to starting the breeding plat, select several hundred choice ears from good vigorous plants and dry and store them as directed earlier in this paper.

Choose a piece of ground of average fertility and as nearly uniform as possible about ten by forty rods, or about two and one-half acres, in area. If possible have the plat eighty rods or more from any other corn, in order to prevent crossing with other corn pollen. Have the seedbed in good condition so that it may be planted at the usual time in May. Run the rows at right angles to dead furrows. From the seed corn selected the preceding fall, select 100 ears that have shown up well in the germination test. Butt and tip these ears, and shell each separately by hand into a small manila paper bag. Number the bags consecutively from 1 to 100. Obtain two bundles of eighteen-inch stakes. These come in packages

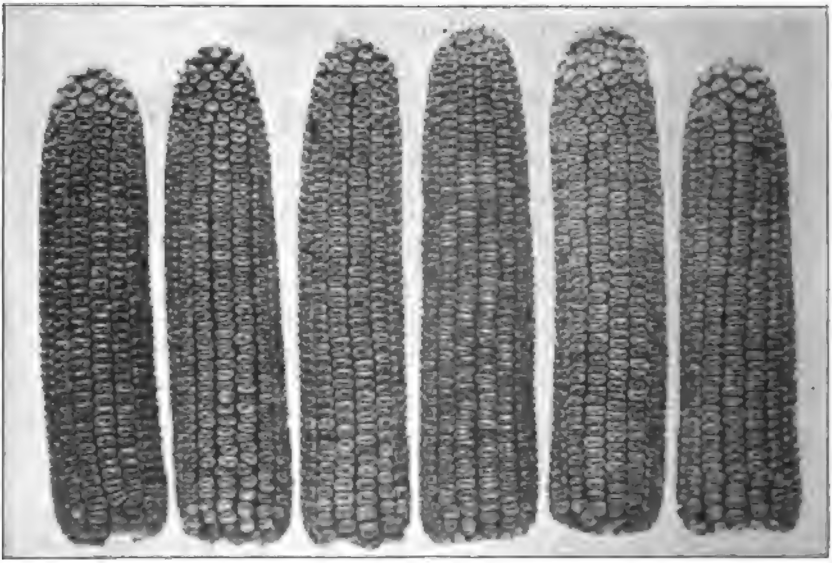

FIG. 40. SAMPLE EARS OF VARIETY WEBBER'S EARLY DENT FROM THE CROP OF 1917
This corn is from the breeding plat of George R. Schauber, Ballston Lake, Saratoga County

of 100 stakes each and are handy to use in marking the rows. There will be 200 rows of 50 hills each. Number the stakes from 1 to 100 and from 101 to 200. Plant the rows marked by stakes 1 and 101 with seeds from bag 1, rows 2 and 102 from bag 2, and so on. Rows 101 to 200 are consecutive duplicates of rows 1 to 100. Use a marker to lay out the rows, place the hills about three and one-third feet apart each way, and plant the seed with a hoe or a hand planter. Using a checkrow planter will materially shorten the labor. Plant four kernels in each hill, and after the corn is up, thin it to a uniform stand of three stalks to the hill. When the planting is done, store in a dry vermin-proof place the numbered bags containing the remnants of the ears planted.

Protect the breeding rows from depredations by ground squirrels, moles, and other enemies. Each row should be given an absolutely even chance with every other row. Cultivate the breeding plat in the same way as the general crop.

In the fall select from each of the best-appearing rows a considerable number of good ears as judged by vigor of plant and yield of corn per plant. Keep a record of the number of the row from which each ear is taken, and dry these ears carefully. When the field is generally mature, husk each row separately and place the corn in a pile with its corresponding numbered stake. Weigh separately the corn from rows 1 and 101,

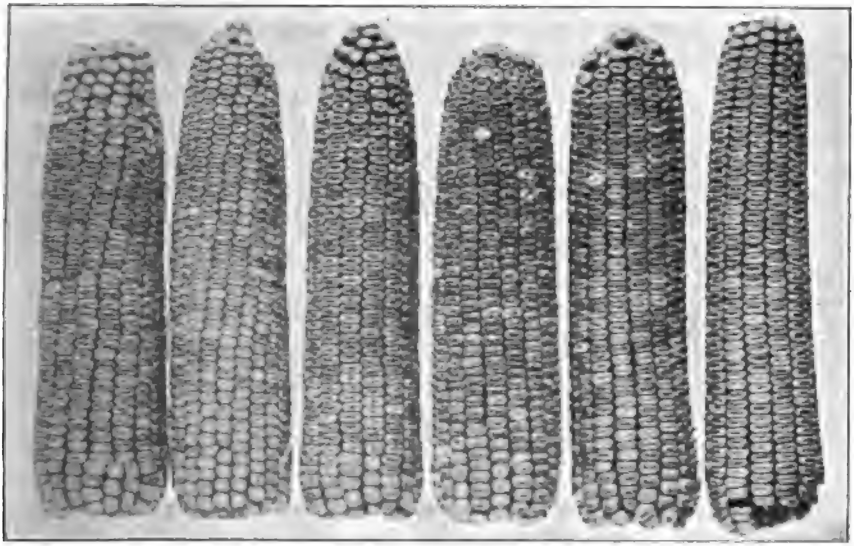

FIG. 41. SAMPLE EARS OF VARIETY CORNELL 11 FROM THE CROP OF 1917
This corn was grown by E. W. Mosher, Aurora, Cayuga County

both of which are from seed of the same parent ear, add the weight of the corn already husked for seed from these rows, and average the weights. Repeat the process for rows 2 and 102, and so on. Discard all rows that are noticeably immature at the usual corn harvest season. In rating each row, consider in addition to weight of corn, relative soundness and stage of maturity of kernels, vigor of plants, size of ears, stiffness of stalks, and the like. Taking all these points into consideration, pick out the best fifteen or twenty rows, and save the seed from these for the next year's crop. From these, select ten ears each from the ten best-yielding rows, and with this seed repeat the test on the breeding plat the next year, taking care that in planting the ears are paired so that no two ears from the same parent row are planted side by side. Use judgment in

deciding on the number of rows from which to select breeding ears. If fifteen or twenty rows of outstanding excellence are found, select the necessary one hundred breeding ears from these; if six or eight, then choose from these. If thought desirable, promising ears from other fields may be introduced into the test, but care should be taken that they are of the same variety.

In the second year a painstaking breeder may use the following short-cut method of obtaining seed from high-yielding strains in addition to continuing the experiment on the regular breeding plat. Note the numbers of the three or four highest-producing rows. Take the kernels left in the correspondingly numbered bags after the previous spring's planting, and plant them in alternate rows in a small separate breeding patch. Detassel alternate rows, and in the fall harvest seed ears only from the detasseled rows. In this way a supply of fully crossbred seed is obtained at once from remnants of ears that have shown high capacity for yield.

The corn breeder has at the end of his first year's work a supply of corn from high-producing rows, which will furnish seed for growing the main crop the second year, the select ears for continuing the ear-to-row work, and the remnants of the original best ears with which to grow a special small crossbred supply of seed.

The second fall, harvest the corn from the breeding plat by exactly the same method followed the first year. Take special care to weigh yields by rows as before and to properly cure and store the seed ears. Again the selection should be rigorous, but a large proportion of the ears not saved for the next year's breeding plat may go into the commercial field and furnish seed for sale. The third year, grow the best selected ears from the breeding plat and the remnant patch by the ear-to-row method, and continue this process from year to year. Remember always that with corn continuous selection is the price paid for success.

Many farmers will not undertake corn breeding because they have the idea that it is a puttering job. They think that it requires too much time and care just at the rush season. This objection really does not hold if the work is properly handled. If the preliminary sorting and testing is done in early spring when farm work is slack and plans are laid in advance of the planting, as can well be done, then the planting and marking of the rows can be done in a day and a half by an energetic farmer. Another half day will be required for thinning the stand. No cultivation is required except such as is given the regular crop. In the fall is the extra work of husking and weighing the duplicate rows and noting the yields and other important points. Properly managed, the amount of extra work involved is not large, and probably in no other way could the extra time be spent to yield greater profit.

SUCCESSFUL CORN BREEDERS IN NEW YORK

There are at present several men in New York State interested in corn breeding. Some excellent work has already been accomplished in adapting and improving early dent corn by such breeders as George R. Schauber, Ballston Lake, Saratoga County; G. D. Brill, Bedford Hills, Westchester County; E. W. Mosher, Aurora, Cayuga County. Such work is needed in Oswego, Jefferson, and St. Lawrence Counties, and little or nothing has been done in some of the central, western, and southern counties. It is quite possible that in the southern tier of counties, where the elevation is not high, a good silage corn could be grown for seed, which would be adapted for use in the great dairy sections of the State where the season is too short to mature seed of the sorts of corn desired. It is also very possible that an early Leaming or other varieties of dent corn would actually yield a higher percentage of dry matter as silage if the seed were grown in this State and the varieties thereby better adapted to local growth conditions. If earlier-maturing sorts of silage corn were grown, the storage of carbohydrates at time of cutting would be more advanced, and damage by early frosts, which is often heavy, would be less. The value of silage corn per acre depends on the amount of dry digestible nutrients rather than on the total weight of green fodder. Careful selection work done at the College and in cooperation with men in different counties of the State has given excellent results. The strain of yellow dent corn known as Cornell 12 is recommended as very promising for grain or silage. The stalk and the ear are somewhat larger than those of a similar strain known as Webber's Early Dent, which with Cornell 11 is recommended for grain purposes. Luce's Favorite may also prove a promising variety of silage corn.

The Department of Plant Breeding of the New York State College of Agriculture will assist in any way possible the work of breeding and growing good seed corn in this State. The Department welcomes any suggestions or inquiries looking toward the establishment of cooperative breeding work and will be glad to furnish all assistance possible to persons who definitely propose to engage in such an enterprise.

READING COURSES IN CROP PRODUCTION

"By planting and increasing his production in every way possible, every farmer will perform a labor of patriotism."—PRESIDENT WILSON, April 10, 1917

In the present crisis it is essential to grow the maximum amount of certain staple farm crops. This must be done with a shortage of labor. As a result the farmer is called upon to carefully plan his rotations and take steps to insure good yields. Knowledge will help to solve these new problems. For example, skillful methods such as the testing of seed will go a long way to safeguard against crop failures. The New York State College of Agriculture is aiding in the solution of the many pressing farm problems by means of correspondence and the distribution of publications. The following series of reading course lessons has been prepared in order to promote the study of different phases of crop production: *Meadows in New York; Alfalfa for New York; The Culture of Sweet Clover and Vetch; Buckwheat; Potato Growing in New York; Field Bean Production; Principles and Methods of Plant Breeding; Methods of Breeding Oats; Improving the Potato Crop by Selection; Improving the Corn Crop by Selection and Breeding.*

These Reading Course lessons are elementary and brief and are intended to arouse a desire for additional knowledge. An Advanced Reading Course in Farm Crops has been instituted in order to provide more complete instruction in accordance with modern correspondence methods. This advanced reading course comprises separate discussions of all of the important crops grown in New York State together with information on crop rotation, the use of fertilizers, seed selection, legumes, and grasses. The problem of establishing the proper crop rotation or of changing the cropping system is one of the most difficult problems of the farmer. The use of fertilizers is becoming more and more common as the price of farm products increases, justifying more intensive farming. Good seed is at the foundation of profitable crop production. Every farmer ought to know how to do his own seed testing. Legumes are an important factor in good farm management not only as soil improvers but as a source of cheap food for livestock. Grasses are the most important crop in New York State.

In all forty-one lessons are given from a textbook supplemented by ten practical exercises. Some of the exercises provide practice in the testing of seed and in the identification of clover and grass seeds, some deal with the important types of cereals and potatoes, and others are field studies. Reports are prepared by each student on the lessons in the textbook and on the practical exercises. The reports receive careful attention from a specialist who corrects and grades them making helpful suggestions whenever possible. The reports are then returned to the reader for review. The only expense for the Advanced Reading Course in Farm Crops is the cost of the textbook, which is not published by the College of Agriculture, and of the materials for the practical exercises.

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 130 POULTRY SERIES NOVEMBER, 1917

REARING CHICKENS BROODER HOUSE CONSTRUCTION

DISCUSSION PAPER

The discussion paper takes the place of the teacher in encouraging thought and self-expression on important points in the lesson, and aims to assist the reader in reviewing and applying them. Each discussion paper filled out and returned is read carefully, and a personal reply is made to questions on any agricultural subject. In order to continue a course, the reader should sign and return the discussion paper so that another lesson may be sent. Questions are included on the discussion paper for the purpose of assisting those readers who desire to give the lesson special study. The preparation of answers is optional.

The available reading course lessons for the farm are arranged in series on the following subjects: THE SOIL, FARM CROPS, LIVESTOCK, DAIRYING, FARM FORESTRY, FRUIT GROWING, PLANT BREEDING, THE HORSE, POULTRY, VEGETABLE GARDENING, FLOWER GROWING, COUNTRY LIFE. New readers may enroll in one or more of these subjects. The first lesson in the series is sent on enrollment, and subsequent lessons are sent, one at a time, on the return of discussion papers. The reader may register for the Poultry Series by signing and returning this discussion paper. The space below on this page is reserved for registration in other series, and also for names and addresses of residents of New York State likely to become interested in the reading course.

(Detach, sign, and return for the next lesson in this series.)

(In answering questions, attach additional paper if needed and number the answers.)

1. What factors must be considered in planning to rear chickens successfully?

2. How many chickens is it advisable to place in a colony brooder house at the start? How would you prevent crowding later?

3. What is the right temperature under the brooder hover?

4. When should chicks be given their first food, and of what should it consist?

5. What are the effects of overfeeding young chickens?

6. What is an ideal range for growing chickens?

7. How can you tell when feed is musty or moldy? What effect does the use of such feed have on chickens?

8. How can you prevent mites and lice from becoming a pest in the brooder?

9. What are the natural enemies of chickens? How can you fight them?

10. What are the essentials for a good brooder?

Name..

Address..

Date..

(*Address all correspondence to the Reading Course for the Farm, College of Agriculture, Ithaca, New York.*)

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 131 | LIVESTOCK SERIES | DECEMBER, 1917

CONTAGIOUS ABORTION OF CATTLE

W. L. WILLIAMS

A HEALTHY CALF

This calf is round barreled and plump. The coat is glossy, and the hairs of the preputial tuft are white, clean, and separate

Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

THE CORNELL READING COURSE FOR THE FARM

"Upon the farmers of this country in large measure rests the fate of the war and of the nations."—President Wilson, April 15, 1917

Under war conditions the skillful work of the man on the land has become more important than ever before. There is indeed every reason for zeal in increasing food production. Knowledge will help to make labor productive. Abraham Lincoln once said, "No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought, as agriculture." The College of Agriculture, thru the Reading Course for the Farm, offers twelve series of lessons for home study free to residents of New York State. The attached discussion paper gives details about these series.

The reading course lessons are elementary and brief. Three advanced reading courses, in farm crops, fruit growing, and vegetable gardening, provide more complete instruction in accordance with modern correspondence methods. Each student provides himself with a textbook and materials for practical exercises. Reports are prepared which are corrected, graded, and returned with criticisms and suggestions.

In a number of communities groups have organized for the discussion and study of common problems, and have adopted the name Cornell Study Club. The primary purpose of a Cornell study club is to furnish an occasion and an incentive for discussing reading course lessons for the farm and for the farm home, but the objects include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. Cornell study clubs are educational and social centers, and should develop local leadership and the human resources of the community. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College.

Correspondence is a medium for the exchange of helpful information. Letters will receive careful attention.

Royal Gilkey,
Supervisor of the Cornell Reading Course for the Farm.

CONTAGIOUS ABORTION OF CATTLE

STERILITY, ABORTION, CALF SCOURS

W. L. WILLIAMS[1]

Contagious abortion, as the term is used here, comprises a group of losses, due so far as is now known to a common cause and interfering severely with reproduction in cattle, with which dairying efficiency is inseparably linked. Manifesting itself in such ways as sterility, abortion, and retained afterbirth in cows, and scours and pneumonia in calves, the disease invades practically all dairy herds the world over, causing the most serious financial loss of any disease of cattle.[2] In New York alone, the annual loss is estimated at not less than ten million dollars.

Contagious abortion, as used in this publication, signifies a chronic infection of cattle — that is, a disease continuing indefinitely and caused by bacteria — affecting prominently the genital organs.

EFFECTS OF THE DISEASE

In the non-pregnant female, the infection may cause an endless variety of disease changes in the genital organs, which may prevent conception. The death of the embryo may be caused so early that its expulsion is not seen. Together these results are designated sterility, or barrenness.

In the pregnant female, the infection may cause metritis, or inflammation of the uterus, or womb. The metritis may cause the death and expulsion of the fetus (abortion), may cause the living fetus to be expelled prematurely (premature birth), or, if the cow goes to full term, may cause retained afterbirth.

The infection in the pregnant uterus passes to the fetus, and plays an important part in causing the death of the fetus and its expulsion (abortion); it may cause the fetus to be severely ill, when born prematurely or at full term, and quickly die; or, in spite of the infection, the calf may be born apparently well, but soon break down from scours, pneumonia, or other disease.

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[1] Professor of Obstetrics and Research Professor in the Diseases of Breeding Cattle, in the New York State Veterinary College at Cornell University.

[2] The statements made in this lesson are based on researches made by the writer and are in conflict at many points with the views commonly held. This lesson has been prepared as an answer to numerous inquiries regarding sterility, abortion, and calf scours, addressed to the College of Agriculture and to the New York State Veterinary College, at Cornell University. The questions at the conclusion of this lesson are intended to assist the reader in reviewing and applying the lesson, and not to encourage questions that cannot be answered by correspondence. The subject is such that many questions cannot be answered except by a veterinarian, after he has made an examination of the animal. The writer requests that no questions of this nature be asked and also that no questions on controversial points be addressed to him. The opinions expressed regarding methods of control and the drugs or apparatus to be used cannot be discussed or argued by the writer, and he cannot undertake to answer questions regarding drugs or plans recommended by others as being preferable.

After calving, the infection may pass from the diseased cow to the calf. The disease discharges from the genital organs flow down the tail, thighs, and udder to the teats, and are taken with the milk by the calf, either directly by sucking or indirectly by a careless milker's drawing the milk and feeding the calf. Healthy calves may get the disease from sick calves thru contact.

The discharges that flow down from the diseased genital tract of the fresh cow may reach the end of the teats and the infection pass up the teat canal, causing some cases of mammitis, or garget.

The dairyman and the breeder should group these various manifestations of the disease under a common head, and not attempt to dissociate them. Sometimes the sterility is most prominent, sometimes the abortion, the retained afterbirth, or the calf scours. The disease cannot be controlled by attacking the phenomenon of abortion alone, but only by regarding the entire group as one problem.

Many believe that numerous abortions are caused by accidents. This is unfortunate, as the disease grows in severity while the dairyman thinks that his herd is secure. So far as recorded, in every cow that has been killed immediately after abortion, infection has been found in the uterus. An accident or bad food may weaken the animal, thereby rendering abortion more probable, but the infection is there and is the fundamental cause.

PREVALENCE OF THE DISEASE

The infection that may cause abortion is essentially universal. In many small dairies, the infection is mild and causes little or no visible harm. It is only when the infection is severe that serious losses follow. Mild infection may become severe from causes within the herd, or a severe type of infection may be introduced from without. Severe infection may be brought into a herd in skimmed milk from a creamery, by buying milk from a highly infected herd, or may be introduced by a cow, a bull, or a calf from a severely diseased herd. It is just as easy to introduce severe infection by bringing into the herd a highly infected bull calf that has never served a cow as by bringing in a cow that has aborted.

HOW IT SPREADS

The infection does not spread readily by ordinary contact, except in the case of scours and pneumonia in newborn calves. A cow may abort or have retained afterbirth and be kept in close contact with pregnant or non-pregnant cows without known danger. For all practical purposes, the disease is spread, so far as is known, almost if not wholly at two periods: when the calf is in the uterus or during the milk-feeding period

after birth; and during copulation between adults. The first of these periods is the more important. In the unborn calf, the infection passes from the uterus of the cow thru the afterbirth, reaches the fluid in which the fetus floats (amniotic fluid), and is swallowed with it. After birth, the infection is swallowed with the milk. Apparently the infection promptly reaches the genital tract of the calf and remains there until breeding age, when it may cause abortion during the heifer's first pregnancy. This appears to be the reason for the great prevalence of abortion in first pregnancy. Recent studies show that the amount of abortion, premature birth, and retained afterbirth during first pregnancy runs parallel to the severity of scours and pneumonia that prevailed in the heifers when young calves. That is, in herds in which large numbers of heifer calves die from scours, those that survive will commonly abort when two years old. In such a herd, the percentage of deaths from scours and pneumonia rises and falls from month to month, and when the surviving heifer calves reach their first pregnancy the abortion rate rises and falls parallel to the prevalence of scours and pneumonia in the heifers when young calves.

The infection that causes the loss in the pregnant cow, whether in the form of abortion, premature birth, or retained afterbirth, is present in the cow's uterus when she becomes pregnant. Either it was in the uterus when she was bred to the bull, or it was introduced by the bull during copulation. If the uterus and the cervical canal, or mouth of the womb, are healthy, when pregnancy occurs the uterine seal is formed very promptly, firmly closing the canal so that infection cannot enter. So far as is known, a pregnant cow or heifer cannot become naturally infected in the uterine cavity after the uterine seal has formed.

Apparently an animal once infected with contagious abortion is always infected, tho the infection may at times decrease until it is scarcely or not at all recognizable. The infection regarded as the cause of contagious abortion has been recognized in the milk of a cow over a period of seven years.

METHODS OF CONTROL

Abortion is incurable, but may be controlled. When abortion breaks out in a herd, anxious inquiries are made as to how the remaining animals may be prevented from aborting. Already the infection is in the uterine cavity, between the uterus and the afterbirth, and may cause abortion, premature birth, or retained afterbirth; or the uterine cavity is free from the infection and the animal will calve safely at full term. Until pregnancy has terminated, it cannot be foretold how it will end. There is no means, except from a complete life history of the animal, for knowing in

advance whether a given cow or heifer will probably abort, calve prematurely, have retained afterbirth, or calve normally.

For a time, some persons thought that the application of the agglutination and complement-fixation tests would reveal the identity of prospective aborters and enable the owner to control the losses by isolating them in advance. However the blood of some cows does not react at all on the day of abortion, and the blood of others reacts highly at the time of normal calving. These tests are interesting experimentally, but valueless for controlling the disease in a herd. Even if the pregnant animals that are to abort could be detected and isolated, this would not control the malady. The isolated cows would still abort, calve prematurely, or have retained afterbirth; the healthy pregnant animals in the herd would remain healthy and calve naturally, whether the severely infected animals aborted in the herd or out of it. In itself, quarantine is useless as a measure of control. The cow gives off the abortion infection for weeks or months before she aborts, and probably still gives off the infection after she returns to the herd. Since many cows abort without being seen, they are not isolated. It is of no use to isolate recognized aborters and leave in the herd just as many unrecognized aborters or other equally or more dangerous cows that have calved prematurely or calved at full term and had retained afterbirth. Isolation is helpful only when the very seriously diseased cow is taken to better quarters and given better attention than she would get in the herd, but the reverse is almost always true. Any benefits from isolation must be indirect: the affected animal must be given a better chance for prompt and, as far as possible, complete recovery, by which she is less dangerous to the herd when the isolation is ended and her breeding is resumed.

Much stress has been placed by some upon the disinfection of the exterior of the cow and of the stable and gutters. If the uterine cavity of the cow is clean, her exterior and the gutter behind her will be free of the infection; if the uterus is diseased and discharging, her exterior and the gutter behind her will immediately become contaminated again, no matter how carefully disinfected. The dairyman should clearly understand that it is the uterus and other internal organs which need disinfection and that no amount of disinfection of gutters or stable can serve any useful purpose in controlling abortion while infected cows stand ready to contaminate the gutters immediately.

It has been claimed that carbolic acid, methylene blue, or other antiseptics given internally to animals having the infection in their uterine cavities, would destroy the infection there and cure the diseased animal. Abundant experience has shown that none of these can cure or in any manner lessen the ravages of the disease. The infection is in the utero-

chorionic space, between the uterus and the chorion — the outer portion of the afterbirth. This cavity is sealed. No blood, lymph, nor other body fluids are carried into it. So far as is known, not a particle of the carbolic acid, methylene blue, or other drug given can possibly enter the cavity where the infection exists; hence these cannot disinfect at the point where disinfection is desired.

The administration of bacterines, vaccines, or sera to the pregnant animal has been advocated, but these have failed. Like antiseptics they fail to reach the location of the harmful infection in the uterine cavity. Their failure does not prevent some establishments from advertising and selling these products.

At present, immunization of the non-pregnant animal — that is, rendering the animal proof against the abortion infection — shortly before breeding is being attempted by the use of the living bacillus regarded as the cause of abortion. Some reports on this plan appear highly favorable in print, like the early reports on the use of carbolic acid, methylene blue, and abortion vaccines during pregnancy. The published reports, based on very imperfect data, afford no secure basis for judgment. The value of the plan is exceedingly doubtful.

Control by immunization is not in harmony with the present knowledge of the disease. Abortion is a chronic infection. The most important difference between a chronic and an acute infection is in relation to immunity. In a chronic disease, the patient may live indefinitely, so far as the infection is concerned, and the infection may persist during the normal lifetime of the animal. In an acute infectious disease, either the infection promptly kills the patient or the patient overcomes the infection and is thereafter immune — that is, the infection cannot again invade the body of the patient. The two types of disease stand quite apart. The chronic infection may become severe and destroy the life of the patient; or the patient, under proper conditions, may acquire a high degree of resistance or tolerance, so that, tho infected, it may not be sick. So far as can be seen at present, the use of abortion bacterines or of living abortion bacilli can neither *cure* abortion nor *eliminate* the infection from a herd or from an animal. It remains to be seen whether the use of living bacilli can increase the tolerance of the patient temporarily, when given to the non-pregnant animal, thereby rendering her next pregnancy safer.

Occasionally a breeder becomes anxious because his bull has been permitted to serve a cow that, he learns later, has previously aborted. The bull has probably run no greater risk than he has repeatedly incurred before by serving cows in the herd which were sterile, had calved prematurely, had had retained afterbirth, or were otherwise severely infected. If proper care is given the bull, as described in this lesson, there is no

recognizable risk; without such care, there is always unwarrantable risk in breeding any cow to any bull.

There are important precautions that may be taken to control the entire group of losses regarded as due to the infection designated contagious abortion. Certain of them can be carried out by the dairyman or the breeder; others can be applied only by the veterinarian specially skilled in this branch of veterinary science. The value of some cattle warrants the application of all the means known that may tend to control the disease; the individual value of many cattle is so small that it is imprudent from an economic standpoint to attempt the application of all known measures. Each breeder or dairyman must decide for himself what he can do personally and what he can or cannot afford to have done by a skilled veterinarian.

Many inquiries regarding sterile cows reach the writer thru the mails. The owner complains that, after repeated services by the bull, the cow fails to conceive. Sometimes, tho the cow has calved some months previously, she shows no signs of estrum, or heat. Such questions are unanswerable except by the veterinarian who examines the animal. The question is wholly one of diagnosis after a careful examination of the entire genital system by a man specially trained in this field.

PRECAUTIONARY MEASURES

If one desires to prevent sterility, abortion, and allied losses, he should, before breeding a cow, have her entire genital system — ovaries, oviducts, uterus, cervix, vagina, and vulva — examined thoroly by a skilled veterinarian. If all parts are healthy, she may be bred at the first opportunity.

If any part of the genital system is diseased, the veterinarian should determine, as nearly as possible, whether she is curable. If incurable, she should on no account be served by the bull, since copulation is injurious and often positively dangerous for both cow and bull. Whenever unprofitable or unsafe in the dairy, the cow should be sold promptly to the butcher. Keeping incurably sterile cows and breeding them repeatedly to the herd bull is apparently one of the commonest means for awakening within a herd a severe type of infection, with the resultant losses.

If a cow is curable and her value warrants employing a competent veterinarian, she should be cured as promptly as possible and, when the veterinarian deems it advisable, should be bred. If she is not worth handling, the owner must take his chances that she may recover without aid or should sell her to the butcher as tho incurable.

When a cow is ready to breed, the exterior of her vulva, the tail, and the surrounding parts should be carefully washed with a warm disinfecting

solution. It is said that some bulls will not serve a cow if the disinfectant has much odor. In such cases an odorless disinfectant, such as 1 to 2000 corrosive sublimate, may be used on the exterior. This is too irritant to be used in the vagina. This organ should be douched with a ½-per-cent Lugol's solution[3] (½ ounce Lugol's solution to 3 quarts of water).

The sheath of the bull should be douched with ½-per-cent Lugol's solution immediately before and after service. The best method for douching is to use an ordinary gallon hospital irrigator with a rubber tube about three feet long, to which is spliced, by a union, a pure gum horse catheter; these two together afford a tube six to seven feet long. Elevate the irrigator to a height of about two or three feet above the back of the bull. Apply oil or vaseline to the catheter and insert it gently up the sheath six to ten inches. Let the douche flow into the sheath freely. At the same time, the end of the sheath should be grasped and compressed, retaining the fluid and distending the sheath. This eliminates the folds in the mucous membrane and washes every part. The distention of the sheath should be repeated two or three times. A similar apparatus may be used for douching the vagina of the cow, but the same apparatus should not be used for both unless the catheter has been boiled after using on the one before using it on the other. The best apparatus for douching the vagina of the cow is a pail fitted with a stopcock to which is attached a pure gum horse stomach tube. The douching should be carried out similarly. The pail is elevated two or three feet above the cow's back and the douche is allowed to flow into the vagina until the cavity is completely filled and the cow forces the fluid out. In this way the folds in the mucous membrane are eliminated and the fluid reaches every part. The horse-stomach tube and the horse catheter may be procured from any dealer in veterinary instruments, either directly or thru a local veterinarian or druggist.

CARE DURING PREGNANCY

When the cow has become pregnant, there is nothing further to be done for the safety of her pregnancy, beyond the general rules of good care. There is no occasion for the owner to get into a panic if some other cow aborts in the same stable or enclosure. If the pregnant cow in question had a clean uterus when bred and was bred to a clean bull, her prospects for calving will not be modified because one or many of her associates abort, calve prematurely, or have retained afterbirth.

The effects of these recommendations reach beyond the question of abortion or premature birth during the ensuing pregnancy. It is desirable

[3] Lugol's solution, or compound solution of iodine, consists of 6 troy drams of iodine crystals and 1½ troy ounces of potassium iodide dissolved in 1 pint of water.

not only that a cow shall not abort, but also that she shall give birth to a healthy calf. In contagious abortion, the infection of mother and fetus is virtually inseparable. If the calf is to be healthy, the uterus in which it develops must be sound. To that end, the disinfection and washing of the uterus and cervical canal, or mouth of the womb, when infected, is the best, and virtually the only means by which reasonable assurance can be given that the animal will breed and produce a healthy calf. The heifer calf is the dairy cow of the near future, and the bull calf the dairy sire. If these cannot be born and kept measurably sound, the dairy industry must fail.

When the pregnant cow is nearing calving time, she should receive special care in regard to cleanliness. It is best not to milk the cow for eighteen to twenty-four hours after calving if she is mature and a heavy milker and consequently liable to milk fever. The idea that, unless milked out either partially or wholly, she is liable to suffer from garget is without known foundation.

THE AFTERBIRTH PROBLEM

The afterbirth should drop away in one or two hours. When it is expelled promptly, the cow usually eats it, apparently without injury.

There is great confusion about the handling of retained afterbirth, and dairymen frequently ask what they had best do. The best course to pursue is to call a skilled veterinarian, and the next best thing is to let the afterbirth alone. There are few conditions that call for greater skill and judgment on the part of the veterinarian. It is utterly impossible for one who has not examined an animal to say whether an afterbirth should be removed, or, if it should be removed, when. Sometimes an afterbirth may be removed with some advantage, but in such cases it would usually come away itself a few hours later. Thus the removal is not highly important.

In many cases it is humanly impossible to detach properly a retained afterbirth from the cotyledons, or "buttons," at any time. Instead, the cotyledon dies and sloughs off the uterus. Then the afterbirth, with the dead cotyledons, comes away or must be removed together. When they are to come away can be learned only by examination. Sometimes the cotyledons are already sloughed away when abortion takes place. It may be eight to ten days or more after calving before the sloughing is completed. Any effort to remove an irremovable afterbirth is highly dangerous. Unless the person in charge knows what to do in a given case, the safest course to pursue is to carry into the cavity of the afterbirth as far as possible an ounce capsule of iodoform or iodoform and boric acid, and leave it there to prevent in a measure the putrefaction

of the membranes while they are becoming detached. Beyond this, nothing should be done except to keep the exterior of the cow, washed, as a matter of general neatness. Retained afterbirth following abortion or premature birth is to be handled the same as when occurring with calving at full term.

The prevention of retained afterbirth is far more valuable and satisfactory than any form of treatment yet devised or that will ever be possible. The foundation for retained afterbirth, laid before pregnancy begins, consists of the infection within the uterus. The dairyman needs to learn that retained afterbirth cannot arise after the cow has calved or aborted, but always becomes established long before calving. What the cow eats or drinks after calving has nothing to do with causing the difficulty, tho it may aggravate or lessen it. The prevention of retained afterbirth rests upon having the uterus clean at time of breeding, and breeding to a clean bull.

When the afterbirth has been expelled or removed, the disease is not cured nor even controlled. There remains the metritis, or inflammation of the uterus, which caused the retention of the afterbirth; and it is just as important to handle the metritis without retained afterbirth as with it. Proper attention to the metritis adds to the safety of the life of the animal, gives increased security for a good milk flow, tends to obviate sterility, and offers the best available insurance against abortion and retained afterbirth in the next pregnancy.

When the afterbirth is out of the way, the uterus may be douched. At first, the uterus will not tolerate antiseptic douches, but only a neutral fluid, such as 0.7 per cent salt solution (one ounce of common salt to one gallon of water). By this means, pus and dead tissues in the uterus may be washed out and recovery favored. Later, the uterus will bear moderate antiseptic solutions. Here, as in retained afterbirth, the decision as to the character, volume, and frequency of the douche needs to be entrusted to the skilled veterinarian. If such a veterinarian is not available or the value of the cow will not warrant his employment, the only resource is to give the animal an opportunity to recover unaided. Then, if the value of the animal warrants, she should be examined by an expert before being bred again. If her value does not warrant such examination, the dairyman must breed her or sell her for beef, as he may think most prudent. No one else is in a position to advise him. In making his decision, he is likely to err. In one case he will sell a valuable dairy animal that would breed well; in another, he will keep an incurably sterile or dangerously diseased animal in his herd. Keeping the incurably sterile animal is a severe financial burden. The retention in the herd of a danger-

ously infected animal may serve as a foundation for a severe outbreak in the dairy, causing great losses.

The plan of selling cows that abort, simply because they have aborted, is a ruinous policy in any herd. If a cow that has aborted receives proper attention and her genital tract is as completely disinfected as possible by a skilled veterinarian, or if she is not too badly diseased and her genital organs unaided throw off the serious infection, she is as safe as any cow. It is futile to sell the cows seen to abort, while a considerable number abort unseen and remain in the herd. It is equally useless to sell a cow that aborts and keep in the herd other cows suffering from the same metritis, or inflammation of the uterus. If the infection in a herd is so severe that thirty per cent abort, it is reasonably certain that another sixty per cent has equally severe infection in the uterus and is just as dangerous in the herd. Many sterile cows are quite as dangerous in the herd as those that have been seen to abort. It is folly to try to control the disease by selling the smaller and keeping the greater number of severely infected animals. The selling of dangerously infected animals for breeding or dairying purposes or for any purpose except slaughter, is a crime of the very meanest kind, perhaps all the worse because of the difficulty of proving legally the crime against the seller. Even should the dairyman deceive himself into believing that he is ridding his herd of the disease by selling some or all of his animals, if he undertakes to buy new cows he will learn after a few trials that some other dairymen try to keep their herds clean by selling their most dangerous animals. Besides, pregnant cattle brought into new quarters and among strange cattle appear to suffer more from abortion, premature birth, and retained afterbirth than if they had been left in their original surroundings. The change of habitat apparently increases the severity of the infection. The dairyman cannot cleanse his herd by trading and selling cattle, but only by keeping the well animals sound, curing the curable, and slaughtering the incurable.

THE REARING OF SOUND CALVES

The growing of sound calves offers to dairymen and cattle breeders the most encouraging field for controlling the ravages from contagious abortion. It is more efficient than attempting to cure diseased adults, and is far more economical. The problem involves intelligent care and a reasonable amount of labor on the part of the dairyman. The details of the work can be, and necessarily are, carried out by the breeder or the dairyman. While the services of the veterinarian are often highly desirable, the amount of veterinary service, and hence the cost, is far less than in the handling of adults for the abortion infection. The growing

of sound calves falls well within the scope of the small dairyman, without a readily available veterinarian, with cows of such low value that adequate veterinary service is a serious or unbearable financial burden.

A large percentage of calves are infected when born. In large herds where abortion is severe, almost all calves are infected at birth. Recent researches in the New York State Veterinary College show that cultures taken from the meconium (the feces in the intestines of the calf at the time of birth) contain bacteria capable of causing disease. When cultures are made on the killing floor from the uterine cavity of the pregnant cow and from the intestinal canal of the fetus, the same bacteria are found in each. When the young calf breaks down with scours, the same bacteria are found in the feces. If the bacteria found in the pregnant uterus, in the intestines of the fetus, and in the feces of the young calf with scours are administered to an adult horse or cow, in increasing doses, until the animal reaches a high degree of resistance, and blood is then drawn from the horse or cow, the serum (calf-scours serum) separated from other parts of the blood, if given in sufficient amount to a calf with scours, generally controls it. Thus is established a strong chain of evidence between the infection within the uterus of the pregnant cow capable of causing abortion and the scours of young calves.

SCOURS

The scours infection in young calves shows many degrees of severity. In some cases the infection is so severe that when the calf is born it breathes but a few times, and dies; the calf has barely escaped being aborted. In other cases the calf is very weak and cannot get up, or stands with great difficulty; it does not scour but grows weaker rapidly and dies (calf septicaemia). In other cases it is weak at birth, and within a few hours scours sets in and the calf grows weaker rapidly and dies. In other cases the scours does not develop for several days; the calf is then stronger, and may live for a number of days, and often recovers. In many cases the recovery from the scours is incomplete, or there is only a very mild scours until the calf is ten to thirty days old, when pneumonia sets in. In other cases, inflammation of the joints and various other symptoms develop.

Escaping these symptoms of severe disease, calves in dairy herds generally show evidence of definite infection. When a calf is born, its hair has a brilliant luster. The calf is ordinarily plump, not gaunt nor pot-bellied. At five to ten days old, the luster of its hair decreases, the hair stands up and is dry and dull like the body hairs of the calf in figure 60, quite unlike the glossy coat of the calf in figure 61. These calves are of the same age, by the same sire, fed approximately an equal amount of

milk, and cared for similarly, except that the first calf, born in a highly infected herd and presumably highly infected at the time of birth, was fed on raw mixed milk from a highly infected herd, and the second calf, apparently sound at birth, was fed on boiled milk.

Another notable difference in the two calves is in the preputial tufts, or sexual hairs, about the opening of the sheath. In the first calf, which conforms to the virtually universal rule, the hairs are matted together and blackened; in the second, the hairs are white, clean, and wholly

FIG. 60. EVIDENCES OF INFECTION

The preputial tuft of this calf eighty-five days old is black and matted, and the coat is rough and lusterless. This calf was presumably infected at birth and was fed on raw mixed milk

separate. Both calves were kept alike; the part was not washed, brushed, nor given any other attention. While it does not appear in the photograph, a calf like that shown in figure 60 practically always has masses of feces adhering to its tail and its buttocks and a calf like that shown in figure 61 never has. A calf like that shown in figure 60 is almost always either gaunt or pot-bellied; a calf like that shown in figure 61 is round-barreled and plump. Other differences might be pointed out. When infected calves, such as that in figure 60, are from one hundred to one hundred and fifty days old and the food shifts largely or wholly from

milk to hay, grain, or grass, the luster of their coats usually returns slowly, their form improves, their rate of growth increases, and apparently they recover. They then resemble the type shown in figure 61, but observations indicate that the recovery is not in all respects complete; the infection has not been eliminated but only brought under control. It still persists in various organs, especially in the genital tract, in a more or less dormant state, ready to be aroused to increased intensity by the new conditions

FIG. 61. EVIDENCES OF GOOD HEALTH

The preputial tuft of this calf eighty-four days old is clean, and the coat is lustrous. This calf was presumably sound at birth and was fed on boiled milk. This same calf is shown on the cover page

arising at breeding age. In the bull the genital tuft of hairs remains black and matted thruout life.

The breeder and the dairyman need not only conserve the life of the calf, but should also take measures to insure its efficiency as an adult. It is necessary to get away from the type of calf illustrated in figure 60 and approach as closely as possible that shown in figure 61. As in all phases of the sterility-abortion problem so in young calves, perfection is not readily, if at all, attainable, but the type of calf shown in figure 60 is definitely avoidable, while the type shown in figure 61 is generally within definite reach without transgressing economic bounds.

The problem of growing sound calves has by no means been solved. Some points in the problem are reliably clear:

1. A large proportion of calves are infected at birth with organisms capable of causing serious losses.

2. Infections similar or identical to those in the calf at birth may be obtained by the calf in large volume after birth, in the milk or by contact with diseased calves.

3. The calf cannot be absolutely protected against the infection, so far as is now known.

4. The infection cannot be entirely eliminated from the calf.

5. The infection can be controlled in a manner to:

   a. Prevent death from scours or pneumonia,

   b. Insure good general health and growth,

   c. Insure the breeding efficiency of the calf when it reaches adult age.

SOME COMMON-SENSE CONCLUSIONS

If the dairyman or the breeder will faithfully addresss himself to the task and apply the knowledge now available, he can exert an enormous influence on the future efficiency of his herd. He cannot in a single year or in several years eradicate a chronic infection, which centuries of carelessness and ignorance have rooted deeply in cattle; but he can promptly and radically better conditions to his advantage, and may continue to improve them as long as he is content to work for such an end.

When the cow has reached her two hundred and seventieth day of pregnancy, or earlier if calving seems imminent, she should be given a thoro bath with warm water and soap; the skin should be lathered repeatedly until it is thoroly clean. She should be rinsed with a two-per-cent solution of cresol compound or other reliable disinfectant and placed in a clean, disinfected stall. Until she calves, the posterior portions of the body — vulva, tail, buttocks, thighs, and udder — should be washed daily with a warm disinfectant solution, such as two-per-cent cresol compound or Lugol's solution. Such care improves the general condition of the cow, and is of value for her own sake. The bathing and the disinfection remove important risks of infection of the udder, or garget. When the exterior of the cow has been cleansed, a calf born in the absence of an attendant, or otherwise not removed immediately from the cow, is largely guarded against infections lodged in the hair and on the skin of the cow.

When the calf is born, it should be removed immediately from its dam, rubbed dry, and the navel stump disinfected. The immediate removal is important for various reasons. If the calf is to be fed by hand, it learns to drink milk more readily if it has not been permitted

to suck. There is no fretting on the part of either cow or calf, if they are separated at once and kept out of sight of each other. During and immediately after calving, there is ordinarily considerable discharge from the genital tract, which, flowing down along the tail, thighs, and udder, reaches the teats and, if the calf is left with the cow and permitted to suck, is taken by the calf. When the afterbirth is retained, the discharges are especially profuse and dangerous and tend to increase as long as the afterbirth is retained. The danger from these discharges can be avoided only by separating the calf from the cow and disinfecting her udder each time just before permitting the calf to suck or drawing milk to feed the calf.

The stump of the navel cord should be disinfected. When the navel cord ruptures in the usual manner and the heart of the calf is normal, there is no bleeding except from the navel veins. When the cord breaks, the arteries, which are elastic, spring back into the abdomen one to two inches above the navel. The escape of the blood contained in the navel vein is important for the health of the calf. As soon as the vein breaks, the blood in it dies and, if not permitted to escape, tends to become infected, decompose, and cause disease. The broken end of the vein should therefore not be tied. It should not be touched with the hands. A goblet or a wide-mouthed bottle should be filled with a 1 to 1000 corrosive sublimate solution. (Corrosive sublimate tablets may be bought of such size that one tablet to one pint of water equals 1 to 1000.) The vessel should be pushed against the navel in such a manner that the stump of the cord will be completely immersed in the solution; it should be kept immersed for at least ten minutes. After the disinfection has been completed, the navel stump should be dusted thoroly with a drying antiseptic powder, such as equal parts of powdered alum and boric acid.

The calf should be kept entirely alone. If placed with diseased calves, it will very probably become diseased also; if placed with well calves, it may, if infected, break down with scours or pneumonia and infect the well calves. There is no occasion to feed a calf until twenty-four hours after birth. If there is severe infection in the herd, if the calf is born prematurely, or if the cow has retained afterbirth, it should be assumed that the calf is severely infected and that the infection is lodged in the intestine, as a part of the meconium, or feces. If milk is allowed to the calf immediately after birth, it serves as a food supply for the bacteria, not for the calf.

There are two means for controlling this danger — enemas and calf-scours serum. The enema should consist of a warm salt solution of the strength of one ounce of salt to one gallon of water. The best apparatus for giving the enema is an ordinary hospital irrigator, to which is attached

a pure gum horse catheter. The irrigator is filled with two to four quarts of the salt solution and held twelve to eighteen inches above the calf, while the catheter is passed gently into the bowel for fifteen to twenty-four inches. The enema very promptly empties the rectum. This treatment may be repeated twice daily for two or three days. Following the enemas, a large part, but not all, of the infection is expelled with the meconium.

USE OF SERUM

In herds where abortion, premature birth, retained afterbirth, and scours are common, it is better that the calf should have liberal doses of calf-scours serum before it has its first feed. Usually it is well to give twenty mils immediately after birth, followed with ten mils morning and evening for four or five days. Should scours set in, the calf may take twenty to thirty mils of serum every three or four hours, if required. The enemas of warm salt solution repeated every four to six hours aid also.

Some persons have reported bad results from calf-scours serum and held that one or two doses of ten to twenty mils have killed calves. At the New York State Veterinary College fifty mils have been given every two hours until five hundred mils and more have been used, with excellent results. So far as researches have gone, the serum is perfectly harmless and may be given in any quantity economically justifiable. Calves of low value do not justify many doses.

After the serum has been given twelve to twenty-four hours, the calf acquires greater resistance to the bacteria present, and milk may be fed with greater safety. The milk for the calf should be from a sound cow — not necessarily the dam nor even a fresh cow — and should be drawn in a sterilized pail, under all the precautions designated for the production of certified milk. Of such milk, the calf may be fed two per cent of its body weight twice daily; that is, a calf weighing fifty pounds may have one pound of milk at each feeding. This rate of feeding may be continued for four or five days, and then cautiously increased to a suitable ration for growth. If scours should set in, the milk should be withheld until the scours is under control. The dairyman should understand clearly that putting milk or other food into a calf with scours is feeding the scours, not the calf.

The dairyman should learn to anticipate the appearance of scours. It is usually to be foreseen by one of two means. When administering enemas of salt solution, close watch will be likely to reveal in the expelled feces small clots or streaks of blood. If the catheter has been used carefully in giving the enema, so that no wound has been caused, the blood in the feces may be regarded as a reliable sign of approaching trouble. Feeding should then be stopped and serum given. Perhaps a

better indication of approaching trouble is the temperature. Rather limited observations on this point indicate that when scours is impending the temperature rises, and drops when the diarrhea begins. A rectal temperature above 102° is highly suspicious, and a temperature of 103° is a positive sign of the approach of serious disease, calling for immediate action. The milk should be withheld, and enemas and calf-scours serum given. The serum may be given in doses of twenty to forty mils, and may be repeated as frequently as every two hours if the case becomes critical. Ordinarily, ten to twenty mils, two or three times a day, will suffice.

CARE IN FEEDING CALVES

As a rule of practice, it is best to start calves on raw milk, rather than on pasteurized or boiled milk. Apparently there is something in fresh milk that tends partly to counteract the infections within a newborn calf and to prevent calf scours in part, and this property is destroyed by pasteurizing and by boiling. Boiled milk — that is, milk heated to the boiling point in a steam cooking apparatus and held at that temperature for half an hour or more — is quite as good for the calf as pasteurized milk, and the boiling is more reliably done. If the cow is badly infected, the calf is born already infected; if the cow is free from the infection, her milk is safe. When calves are born healthy and free, or essentially free, from infection, they thrive well from the first on boiled milk, but these are exceptional calves.

After a calf has been fed on raw milk until eight or ten days old, and is well, it is safe to change to boiled milk. This adds greatly to the safety of the calf when it is fed mixed milk from the herd. When separated milk is procured for calf food at a creamery obtaining milk from cattle known or suspected of having severe abortion infection, thoro heating of the milk is imperative. Boiling is by far the safer plan. Time and again, an attempt is made instead to pasteurize milk, with the result that the plan has broken down and the calves have become affected. In pasteurization, there is only a very slight margin of safety, so that an error on the part of the operator is highly probable. Boiling the milk offers a greater margin of safety, and, so far as researches have shown, boiled milk is quite as digestible and nutritious for the calf. After the first ten days, so long as the calf is to be fed mixed milk from the herd or milk from a questionable source, it should be boiled in order to guard against disease. If this is done, and the raw milk fed during the first ten days is from a safe source, the feeding of dairy calves is placed on essentially the same basis of security as that of beef calves, which suck their dams only. If in addition each calf is kept in isolation, so that it cannot transmit disease to or receive disease from other calves by sucking each other or by eating

food or bedding soiled by discharges from sick calves, it is given an opportunity to grow up without serious infection.

This plan for growing sound calves has special value also in connection with tuberculosis. Much tuberculosis is caused by feeding calves with milk from tuberculous cows. Such milk cannot be fed raw without exceedingly great risk. The recommendations given for feeding calves to prevent contagious abortion, with slight amendment, answer perfectly for preventing tuberculosis. The necessary change is confined to the first ten days, when raw milk is advised. If the dam is tuberculous, the raw milk to be fed the newborn calf must be taken from a non-tuberculous cow, or the milk must be boiled from the first. If boiled milk is used from the first, large amounts of calf-scours serum must be given, to prevent scours and pneumonia.

From the close of the milk-feeding period, up to breeding time, the health of the calf is quite secure. Then, so far as practicable, the heifers thus grown should be bred to bulls grown in a similar manner. As soon as the heifer becomes pregnant, if her uterus is healthy and she has been bred to a healthy bull, she is as safe as it is practical to make her, up to calving time, when her care should be in harmony with the rules given on page 168.

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 131 LIVESTOCK SERIES DECEMBER, 1917

CONTAGIOUS ABORTION OF CATTLE

DISCUSSION PAPER

The discussion paper takes the place of the teacher in encouraging thought and self-expression on important points in the lesson, and aims to assist the reader in reviewing and applying them. Each discussion paper filled out and returned is read carefully, and a personal reply is made to questions on any agricultural subject.[4] In order to continue a course, the reader should sign and return the discussion paper so that another lesson may be sent. Questions are included on the discussion paper for the purpose of assisting those readers who desire to give the lesson special study. The preparation of answers is optional.

The available reading course lessons for the farm are arranged in series on the following subjects: THE SOIL, FARM CROPS, LIVESTOCK, DAIRYING, FARM FORESTRY, FRUIT GROWING, PLANT BREEDING, THE HORSE, POULTRY, VEGETABLE GARDENING, FLOWER GROWING, COUNTRY LIFE. New readers may enroll in one or more of these subjects. The first lesson in the series is sent on enrollment, and subsequent lessons are sent, one at a time, on the return of discussion papers. The reader may register for the Livestock Series by signing and returning this discussion paper. The space below on this page is reserved for registration in other series, and also for names and addresses of residents of New York State likely to become interested in the reading course.

(*Detach, sign, and return for the next lesson in this series.*)

[4] The subject of this lesson is such that many questions on it cannot be answered except by a veterinarian, after he has made an examination of the animal. The writer requests that no questions of this nature be asked and also that no questions on controversial points be addressed to him. The opinions expressed regarding methods of control and the drugs or apparatus to be used cannot be discussed or argued by the writer, and he cannot undertake to answer questions regarding drugs or plans recommended by others as being preferable.

(In answering questions, attach additional paper if needed and number the answers.)

1. Do you keep careful records of the breeding efficiency of your cows? How many cows do you keep?

2. On the average, how many times has it been necessary for each cow to be served by the bull before she became pregnant?

3. How long an interval, in months, between calvings do you consider desirable in dairy cows? How nearly do you succeed in reaching the mark?

4. How many cows and heifers have you sold because they have failed to become pregnant?

5. How many abortions have occurred in your herd in the past two years? What did you consider the cause?

6. How often have you observed retained afterbirth? How have you handled it?

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7. Do you regularly employ a veterinarian for retained afterbirth, or do you handle it yourself?

8. What losses have you suffered from calf scours? At what ages have the calves suffered usually? What have you done to control the scours?

9. What are your ideas regarding the abortion problem as a whole?

Name...

Address...

Date..

(Address all correspondence to the Reading Course for the Farm, College of Agriculture, Ithaca, New York.)

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
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LESSON 132 FOOD PRESERVATION SERIES JANUARY, 1918

DRYING FRUITS AND VEGETABLES IN NEW YORK STATE

E. L. KIRKPATRICK

STRING BEANS, FRESH AND DRIED
The twenty-six pounds of fresh beans were reduced to two and one-half pounds by drying

Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

THE CORNELL READING COURSE FOR THE FARM

SUPERVISOR
ROYAL GILKEY

EDITORS FOR THE COLLEGE
BRISTOW ADAMS
RUTH VAN DEMAN

" Upon the farmers of this country in large measure rests the fate of the war and of the nations."— PRESIDENT WILSON, April 15, 1917

Under war conditions the skillful work of the man on the land has become more important than ever before. There is indeed every reason for zeal in increasing food production. Knowledge will help to make labor productive. Abraham Lincoln once said, " No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought, as agriculture." The College of Agriculture, thru the Reading Course for the Farm, offers twelve series of lessons for home study free to residents of New York State. The attached discussion paper gives details about these series. The reading course lessons are elementary and brief. Three advanced reading courses, in farm crops, fruit growing, and vegetable gardening, provide more complete instruction in accordance with modern correspondence methods.

In a number of communities groups have organized for the discussion and study of common problems, and have adopted the name Cornell Study Club. The primary purpose of a Cornell study club is to furnish an occasion and an incentive for discussing reading course lessons for the farm and for the farm home, but the objects include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. Cornell study clubs are educational and social centers, and should develop local leadership and the human resources of the community. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College.

Correspondence is a medium for the exchange of helpful information. Letters will receive careful attention.

DRYING FRUITS AND VEGETABLES IN NEW YORK STATE

E. L. Kirkpatrick

Every orchardist and market gardener should become familiar with the methods of drying fruits and vegetables. The present situation demands foods that contain the maximum of value in proportion to weight and bulk, and that are in suitable form for shipment. Dried fruits and vegetables meet these requirements. Drying reduces fresh fruits and vegetables to from one-fifth to one-tenth of their original weight and to one-third to one-half of their original bulk; this means great economy in both space and cost of transportation. Drying also solves the problem, often faced in canning, of getting containers, for dried food products keep well in paraffined or parchment-lined pasteboard containers. The tin plate of which cans are made is needed for war purposes.

The terms *dried*, *evaporated*, *dehydrated*, and *desiccated* have been applied to dried fruits and vegetables and are more or less confusing to the general public. Some authorities, while acknowledging slight differences between certain pairs of the four words, class them all as practically synonymous; others distinguish between dried and evaporated on the one hand, and dehydrated and desiccated on the other. According to these authorities dried or evaporated refers to fruits or vegetables from which the moisture has been removed with little or no regard to the degree of heat used, while dehydrated or desiccated refers to products from which the moisture has been expelled under a relatively low, uniformly controlled temperature, preferably from 100° to 160° F. Caramelization, which may result from excessively high temperatures during the process of evaporation, is prevented by the low even temperature used in dehydration. From a trade standpoint *dried* vegetables have been classed as those preserved in the rays of the sun or over the kitchen range for home use, *evaporated* as those dried in the common type of kiln plant, and *dehydrated* or *desiccated* as those handled in a steam-heated cabinet drier.

What distinction should be made between the four terms, is questionable. Only by the application of delicate tests, if at all, can certain products properly handled in a modern evaporating plant be distinguished from those handled in dehydrating or desiccating outfits. In this publication the four terms are used synonymously, and the emphasis is placed on the importance of producing a high-grade article regardless of the system used.

PREPARATION OF EGGS FOR MARKET

EARL W. BENJAMIN

Poultrymen have obligations to their community and to the country at large to help reduce the cost of living by efficiently and properly handling the eggs from their flocks. Many farmers do not realize that an important reason why the farmer receives so much less for his eggs than the consumer pays for them, is that at least thirteen eggs must leave the farm for each dozen purchased by the consumer, and probably not over four first-quality eggs reach the consumer from each dozen sold by the farmer to the country buyer. The quality of eggs gradually deteriorates from the time they are laid until they are consumed. Careful study has shown that over one-half of this deterioration often occurs on the farm.

STRUCTURE OF EGGS

Eggs were not designed by nature to be marketed as a food product for man; they were designed for natural incubation. They are very delicate in structure and are greatly affected by such conditions of marketing as being kept for long periods, rough handling, changes in temperature and humidity, and lack of cleanliness.

A fresh egg opened into a dish is illustrated in Plate I, 1. The yolk may be light or dark yellow, depending on the season and the food or the individual characteristics of the hen. The yolk of the fresh egg as it is first opened out on a flat surface should lie in a relatively rounded form, it should not be over three times as broad as it is deep, and it should not rupture easily. The germinal disk, the point at which the germ of the fertilized egg develops, appears as a small light-colored spot on the surface of the yolk (Plate I, 2). If the egg is fertile, this spot is about one-eighth inch in diameter and is round; if infertile, it is usually smaller and irregular in shape. The yolk is normally about in the center of the egg, but, because of its fat content, it is lighter in weight than the white; therefore if the egg lies still for several days at a temperature of 60° F. or over, the yolk will rise and stick to the upper side of the shell.

The white cords, which appear like little knots of loose cotton twisted with thread, on the sides of the yolk toward the ends of the egg, are called the chalazae. They are drawn up close to the yolk and are very distinct. They allow the yolk to turn readily in a lateral direction if the egg is twirled, but tend to act as an anchor to prevent the yolk from rising rapidly toward the shell. The chalazae are a part of the first

albumen, or white, to be deposited on the yolk when the egg is being formed in the oviduct of the hen. The larger part of this first albumen forms a thin layer, which covers the yolk in the freshly opened egg. Another portion of the white stands around the yolk in a somewhat jelly-like mass, and the remainder is in the form of a viscous fluid. The white of the fresh egg, except for the chalazae, is nearly transparent, altho in the denser parts close to the yolk there is a yellowish green tint.

The shell is about one-sixtieth of an inch thick in normally strong-shelled eggs, and is covered with a gelatinous coating that gives the fresh egg a natural bloom. The shell is porous, permitting the easy absorption of water, flavors, and odors, and the evaporation of the contents, especially if the protective gelatinous coating has been washed or rubbed off. Inside the shell are two shell membranes, which serve as additional barriers against injury to the egg. Both membranes are made up of a network of fibers and are moist and elastic.

When the egg leaves the body of the hen and still contains all of its animal heat, the contents completely fill the shell; but as soon as the egg begins to cool, the contents contract more than the shell, and a space filled with air drawn in thru the shell is formed between the two shell membranes. When the egg has just cooled, this space is about the size of a dime, and is usually near the large end but sometimes at other points, depending on where the membranes separate most readily. The air space increases as the contents of the egg decrease in volume thru evaporation.

A hard-boiled egg cut in two lengthwise also shows the structure plainly (Plate I, 3); the colors used in this plate represent those of the raw egg.

CANDLED APPEARANCE OF FRESH EGGS

The farmer should become acquainted with the candled appearance of eggs, as this is a convenient and fairly accurate way to detect the quality of eggs without breaking them. Candling an egg is done by looking thru it when held in front of a bright light (fig. 70). A satisfactory yet inexpensive device for this work can be arranged by wrapping a piece of cardboard about the glass chimney of an oil lamp, tying it securely, cutting a round hole one inch in diameter opposite the flame, and placing the apparatus in a darkened room (fig. 71). There are many other satisfactory styles available on the market, among them tin shields to be used over oil or other lights. If a daylight candler can be used (fig. 72), the work is very much facilitated as it may be done at any convenient time and without darkening the windows. A strong light is desired, especially for brown-shelled eggs, for it will permit more rapid and more accurate work. A gas light with a mantle or an electric light gives

very good results. The heating caused by candling is detrimental to the quality of the eggs; therefore the candling apparatus should be so constructed as to allow a free circulation of air, such as the arrangement shown in figure 70. Rapid candling in a cool or chilled room helps to avoid this trouble. A convenient bench under the candling apparatus facilitates the rapid handling of the eggs.

For candling, the egg should be held with the large end up (fig. 70), so that the air space will normally be at the upper end. Just before the egg is placed at the lighted opening, the contents should be set whirling by a quick turn of the wrist, so that the condition of the egg may be easily observed. The egg must be held below the level of the eye (fig. 71) if the candler is to see the air space as well as the yolk. Such a position also prevents the light from shining directly into his eyes.

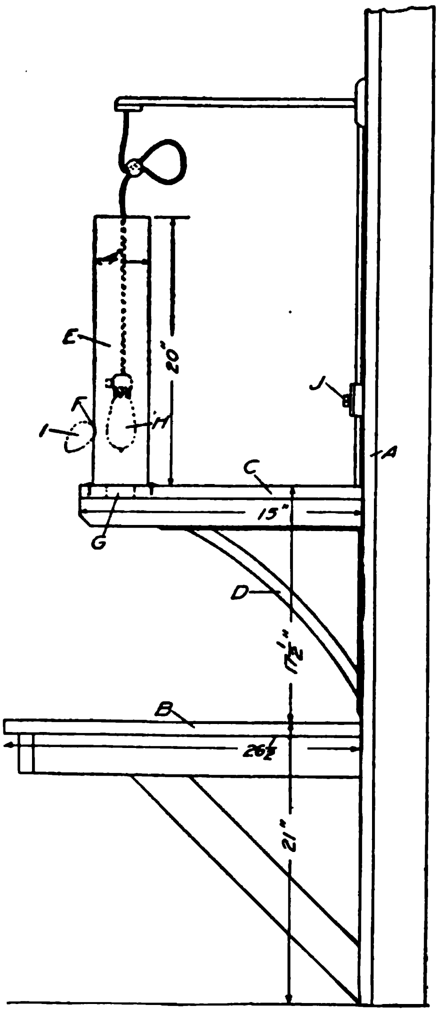


FIG. 70. PLAN OF EGG CANDLING ROOM SHOWING BENCH, SHELF, AND CANDLER

A, wall of candling room; B, bench for eggs; C, shelf for fillers, packing, and candling apparatus; D, bracket to support shelf; E, tin pipe candler; F, one-inch opening opposite light; G, two-inch opening thru shelf for ventilation and lighting; H, sixty-watt electric bulb; I, egg in position for candling; J, electric switch

The normal appearance of a fresh white-shelled egg as it is being candled is shown in Plate III, 1. The whole egg appears pinkish yellow, but by looking closely one can see the air space at the upper end and the diffused shadow of the yolk in about the center. A dark spot usually follows or precedes the yolk as it turns around. This is the end of one of the chalazae, and is always accompanied by a slight reflection of light from the white color of the cord itself. The shell membranes are firm around the air space. The brown-shelled egg (Plate III, 2) is as fresh as the white-shelled egg (Plate III, 1), but the pigment of the brown shell gives the former a darker color.

ABNORMAL DEFECTS OF EGGS

In nearly all flocks there are certain hens producing defective eggs. All eggs used for incubation should be candled and all abnormal ones culled; in this way the eggs from hens having this characteristic will be discarded and the flock gradually cleared of any inherited tendency to produce abnormal eggs.

BLOOD CLOTS AND BLOODY EGGS

The occurrence of blood clots is probably the most common fault found in fresh eggs (Plate II, 3; Plate III, 5). They are caused by the rupture of a blood vessel in the ovary of the hen when the yolk is fully developed and just as it is released from the ovary to pass down thru the oviduct where the egg white is deposited. The clot thus formed remains on the surface of the yolk and often appears as only a streak. When the egg is candled, the clot appears as a bright red spot or streak, and can be easily distinguished if of ordinary size and if the egg is well twirled. In most instances the blood in the clot is not diffused thru the white, but if it is, the egg is termed *bloody*. Eggs containing blood clots but not bloody are satisfactory for use if the clot is removed, but because they are imperfect and since their cause is not generally understood by consumers, they should be culled from the market eggs and used at home. When the egg is opened, the blood clot can usually be removed readily by a spoon.

FIG. 71. A HOMEMADE CANDLER
This is made from cardboard wrapped around an oil lamp

Bloody eggs (Plate II, 3; Plate III, 5) are not so common as eggs containing blood clots. The candled bloody egg has a red tint thruout, and in many instances is the general color of a brown-shelled egg. Bloody eggs are often caused by a spreading of bloody coloration from a blood clot (Plate III, 5), but they may also be due to a diseased or injured condition of the oviduct, causing blood to be exuded with the egg white when the egg is being formed. The bloody egg white is not used for food, because it does not seem wholesome, rather than because of any known danger. The yolk, however, may be used.

MEAT SPOTS

Substances resembling flesh or pieces of liver are sometimes observed floating in the egg white, either entirely free or attached to the chalazae. Eggs containing such substances are called *meat spots* (Plate II, 4; Plate III, 6). The floating particles vary in size and color. They may be grayish white, in which case they are probably portions of loosened glands that have been torn from the wall of the oviduct as the egg passed thru; or they may be red or flesh color, in which case they are probably abnormal growths of tissue that frequently develop in the oviduct and are later dislodged when an egg passes thru. The meat spot as it appears when the egg is candled is often confused with the dense chalazae and the blood clot. The meat spot is darker than the chalazae and is not accompanied

FIG. 72. A TYPE OF CANDLER THAT CAN BE USED IN A LIGHTED ROOM

by the slight reflection of light that characterizes the latter; it is also duller and more opaque than the blood clot, which is red and slightly transparent. An egg having this defect is as a rule entirely suitable for food purposes after the meat spot is removed.

THIN-SHELLED EGGS

Some hens usually lay eggs with hard yet very thin and porous shells. This is sometimes caused by a scarcity of lime in their rations. Such eggs (Plate VI, 6 and 7) allow very rapid evaporation and undoubtedly permit an easy entrance for invading bacteria. These eggs can be detected while candling by the porous and colorless spots appearing on the shells. If very defective in this regard, they should not be shipped with normal eggs, because they are likely to become checked or broken. They should be used at home or sold locally.

SOFT-SHELLED EGGS

Very often during the season of heavy production, or if a supply of lime, such as oyster shell, is not kept before the hens, or if the hens, due to some abnormal condition, are unable to absorb and secrete the lime necessary for eggshells, a considerable proportion of the eggs have no shells at all over the shell membranes, or there are only soft shells. These eggs ordinarily have normal contents, and should be separated from the normal eggs and used as soon as gathered.

BLIND CHECKS

Some eggs become checked while the shell is being formed inside of the hen, and more lime is deposited over the crack, thus virtually resealing the egg. Such eggs are termed *blind checks*. These checks in the shell are invisible, except for lines or slight ridges, unless the eggs are candled. Since the shells of blind checks are weakened, they will often break and smear other eggs during shipment; therefore they should be sorted from the other eggs and sold locally.

FIG. 73. RECEPTACLES FOR GATHERING EGGS

The sides of the basket crowd the eggs and the bottom sags when the basket is full. The pail is rigid and hence is preferable

DARK YOLKS

Excessive consumption of green food, such as the ravenous eating of rape, which often occurs when the hens are first allowed access to it in the spring, sometimes makes the yolks very dark, in some instances so dark as to render the eggs unsalable. In such a case, when the egg is candled, the yolk will often appear darker than that shown in the egg in Plate III, 4, and will have a greenish rather than a red tint. Unless the eggs possess a strong odor they may be used at home.

Some markets and customers may demand an egg with a pale yolk. The shadow of such a yolk may appear even lighter than that in Plate III, 1. Yellow corn, green food, and general ranging cause the yolks to be dark yellow, while white corn, wheat, buckwheat, and lack of exercise cause light yolks. These slight variations in the color of the yolks do not indicate any difference in the food value of the eggs.

BODY-HEATED EGGS

Fresh-laid eggs are sometimes found to be somewhat heated (Plate III, 3 and 4), except that no evaporation has occurred; or they may have the

appearance of incubated fertile eggs (Plate I, 4; Plate IV, 1). This heating has been caused by the hen's holding the egg inside her body after it is completed and ready to be laid. The body is at incubation temperature, and deterioration of an egg so held is very rapid. Disease or fright occasioned by rough handling or shipping is usually the cause of such a condition in the hen. If in edible condition, body-heated eggs should be consumed without delay.

WATERY EGGS

During the latter part of the laying season, that is, during the late summer, hens seem to have a tendency to produce eggs containing more water. Often these may be detected when candling, by a looseness of the membrane around the air cell. Such eggs usually evaporate more rapidly than normal eggs, and they should be consumed as soon as possible.

FIG. 74. COOLING EGGS BY A CANOPY OF DAMP CLOTH

The pans of water above and below the eggs keep the cloth moistened so that the air surrounding the eggs is moist and cool

DOUBLE-YOLK EGGS

Eggs with two yolks are very common and can be easily detected by the two distinct shadows seen while candling, even if the increased size of the egg is not sufficient indication. These eggs are as good as any, but to keep the salable product uniform they are generally used at home.

OTHER ABNORMAL TYPES

Certain foods, such as onions and cabbage, and sometimes other substances picked up around the barnyard by the hens, seem to impart an odor and flavor to eggs. Such instances are rare, but when handling the eggs the odors can usually be detected and unless they are objectionable the eggs may be satisfactory for home use.

During the course of a year's production, many peculiar types of eggs will be laid by apparently normal fowls. These may include loose shell membranes floating in the egg white; eggs within eggs; foreign substances within eggs, these substances sometimes replacing the yolk; intestinal worms within eggs; and abnormally shaped eggs. Such abnormal types are not common, and when they do occur they are easily detected and should be opened and examined as a source of information.

FARM CONDITIONS LIKELY TO AFFECT THE QUALITY OF EGGS

A knowledge of the factors involved in the deterioration of market eggs on the farm is necessary in order that the farmer may handle his eggs well by using the facilities he already has. These injurious influences are mentioned separately, but the real cause for the deterioration of the eggs on any particular farm may be a combination of several.

TEMPERATURE

The older or more inferior an egg is, just so much more rapidly will it be affected by extremes of temperature.

REMOVAL OF ANIMAL HEAT

Eggs should be cooled to at least 68° F. immediately after they are laid; 40° F. is ideal, but any temperature from 40° to 60° gives excellent results. Every hour of heating above these temperatures is responsible for some deterioration in the quality of the egg whether fertile or infertile, but is especially disastrous to a fertile egg.

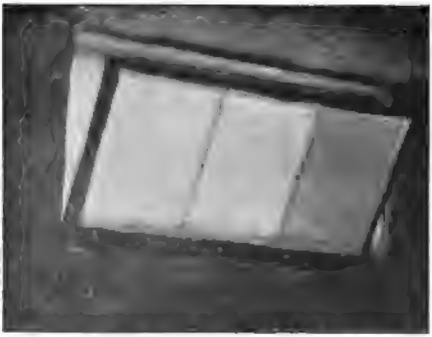


FIG. 75. WINDOW FRAME COVERED WITH CLOTH CURTAIN

This is a good method of ventilating cellars in which eggs are held

A very slight development of the embryo is apparent in a new-laid fertile egg (Plate I, 2), and if the animal heat is not removed at once, this development soon continues to such an extent that it can be seen by candling. After a fertile egg is heated to a temperature of 100° to 105° F. for only five hours after being laid, the embryo is so well developed that the rings around the germinal disk can be easily distinguished if the egg is opened. If a white-shelled egg is candled after twelve hours of such heating, the embryo can be seen (Plate I, 4; Plate IV, 1). If the embryo is weak or if the temperature is allowed to fluctuate beyond a range of about 102° to 105° F., the embryo dies, causing the formation of a blood ring (Plate IV, 3); then decomposition sets in, and the egg rots (Plate IV, 8). A fertile egg kept at a temperature as low as 68° F. for several days will develop slightly but not enough to be visible when candled. Eggs showing any blood due to development of the embryo should be culled as worthless for human food, whether the embryo is dead or alive.

If the animal heat is retained in an infertile egg, the only damage resulting is rapid evaporation and other changes not definitely known but marked in the following ways: the yolk becomes slightly more opaque,

the white becomes watery, and the inner shell membrane becomes darkened around the air cell (Plate II, 2; Plate IV, 4). In candling eggs that have been incubated, it is very difficult to be sure which ones are infertile, but since even those that are will not withstand so much handling as fresher eggs, they should be consumed within two weeks. All such eggs should be inspected as they are broken open because of the common occurrence of slightly matured embryos that were not detected by candling.

Eggs may be infected with bacteria when first laid, or they may easily become so if they are cracked, have soft or weak shells, or if they even become moistened. *Bacterium pullorum*, which causes bacillary white diarrhea in chicks, has been recently found to occur somewhat commonly in eggs when fresh laid, but the exact effect of this type of bacteria on the person consuming the eggs is not known. Unless the animal heat is removed, these bacteria will develop rapidly. At first the change due to bacterial development is slight, beginning with the disintegration of the yolk and the white and the consequent watery condition of the egg contents; later the egg rots.

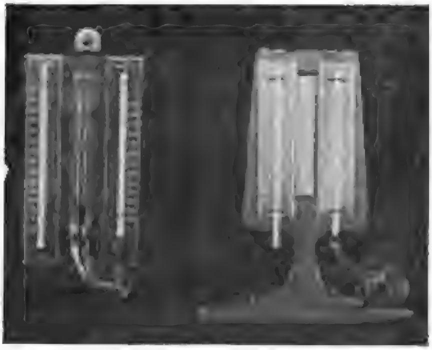


FIG. 76. TWO TYPES OF WET- AND DRY-BULB HYGROMETERS FOR DETERMINING THE HUMIDITY OF THE ATMOSPHERE

The particular sort of deterioration resulting from bacterial infection depends on the type of bacteria causing the trouble. If the egg, when candled, is of approximately the normal general color, but the yolk appears broken up and disintegrated instead of being a distinct shadowy form separate from the white, the egg is probably at about the stage called white rot (Plate IV, 7). Later it becomes darker in color (Plate IV, 8). The odor is usually either sour or strong.

SUBSEQUENT HEATING

If while eggs are being held for shipment they become warmed to a temperature of about 60° F. or more, deterioration of the contents begins. If the eggs are heated after being laid, the effects are the same as when the animal heat is not removed. An egg held at a temperature of 70° F. for about one week is shown in Plate III, 3; if held for one or two weeks longer, it has the appearance of the egg in Plate III, 4.

Portions of the egg white begin to coagulate at about 140° F. Such a temperature is often reached in strong sunlight or in egg receptacles set close to a stove. Such eggs have the appearance of, and are essentially

the same as, boiled eggs, and can be detected while candling by the opaque appearance of the egg white (Plate III, 8). They will keep well during shipment but are useless for market because of their abnormal appearance; they should be consumed at home.

FREEZING

Eggs will freeze at about 28° F. Freezing breaks down the structure of the white, causes the contents of the egg to become watery, and by the expansion of the water in the egg almost invariably causes the shell to crack, thus promoting more rapid evaporation and affording an easy entrance for bacteria and odors. A frozen egg may be detected while still frozen by the frosty feeling of the shell and afterwards by the cracked shell, which appears to have been split lengthwise. When candled, the contents of frozen eggs appear loose around the air cells and sometimes even frothy if twirled vigorously. Such eggs should either be consumed at home or sold where they will be used at once.

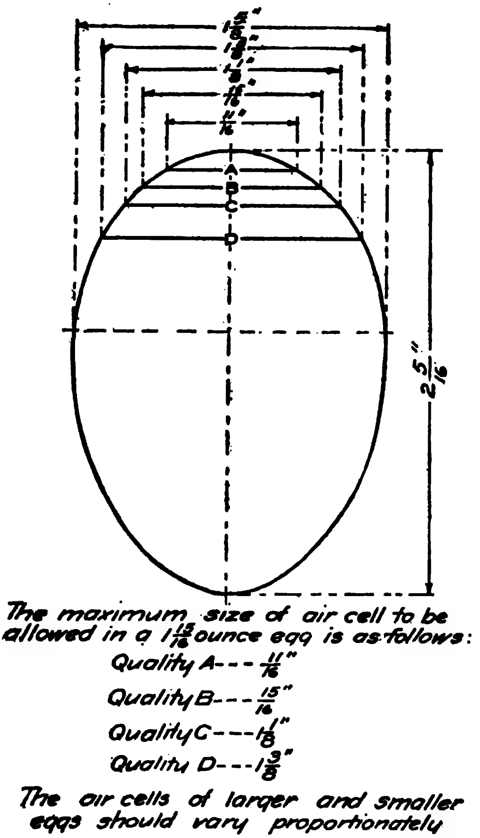


FIG. 77. DIAGRAM SHOWING SIZE OF AIR CELL TO BE ALLOWED IN COMMERCIAL QUALITIES OF EGGS

CHANGES OF TEMPERATURE

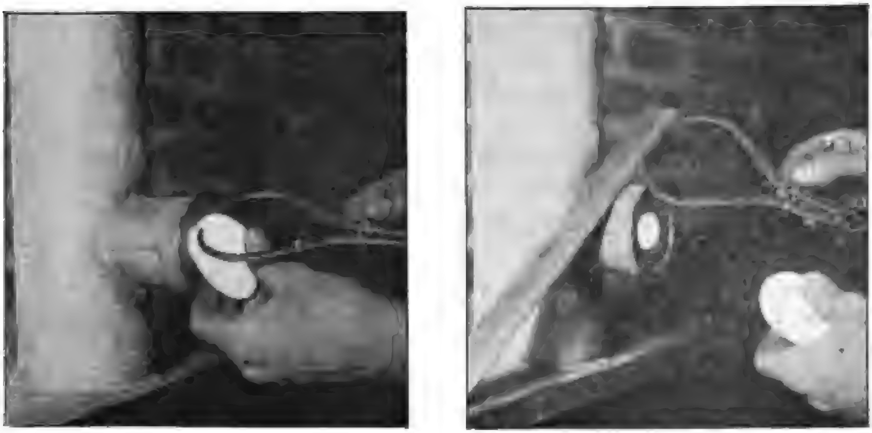
If cold eggs are brought immediately into a warm atmosphere, there is danger that moisture from the warm air may condense on them for the same reason that moisture collects on dishes brought from the refrigerator into the warmth of the kitchen. This sweating of the eggs is liable to cause mustiness, molding, or absorption of flavors. If the eggs are warmed gradually instead of suddenly or if the warming is done in a very dry room, sweating will be avoided. Sudden changes of temperature tend to destroy the usefulness of the network of fibers that is responsible for the jelly-like consistency of the white of a fresh egg and that helps to prevent rapid evaporation and easy infection.

HUMIDITY AND TEMPERATURE

The effect of the humidity of the air on eggs is so dependent on the accompanying temperature that the two factors must be dealt with together.

EVAPORATION

The porous shell and shell membranes permit the easy evaporation of moisture from the egg as shown by the increasing air space (Plates V and VI). Eggs with weak shells evaporate much more rapidly than those with strong shells. Warmth, dryness, and rapid changing of the air tend to increase the rate of evaporation; thus warm dry air blowing over eggs will cause the most rapid evaporation. Eggs that have evaporated are



A B

FIG. 78. MEASURING THE AIR CELL OF AN EGG WITH CALIPERS

A, applying the calipers to the egg; B, getting the measurement from a ruler

weak and watery and very soon develop a stale flavor. They will not stand shipment satisfactorily.

YOLK STICKING TO THE SHELL

If the contents of the egg are evaporating or if they are considerably evaporated and the egg is warm, there is particular danger that the yolk will rise and stick to the shell (Plate IV, 5). At the cold storage temperature of 30° F. an egg will remain for a year or even longer without the yolk sticking even tho the egg is not turned, because the cool unevaporated egg white is firm enough to hold the yolk in place; but if the egg white is warm or evaporated so that it becomes weak and watery, it cannot properly hold the yolk. If an egg is kept with the large end up, the yolk is not so likely to stick, but such care is necessary only when the conditions under which the eggs are held or the time of

holding are unreasonable. An egg with a stuck yolk may be detected when candling by noting that the yolk remains in one position close to the shell. If the yolk is only slightly stuck, it may often be shaken loose by rotating the egg. While such an egg may be used for immediate consumption, it should not be shipped because the vitelline membrane is so weakened that the yolk will soon mix with the white.

MOLDS AND MUSTINESS

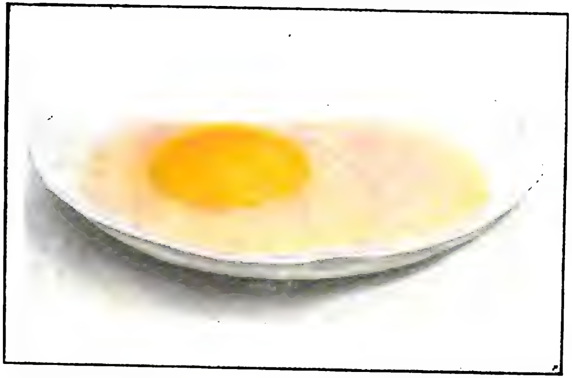
Any wetting of the shell of the egg should be carefully avoided. There is grave danger of mustiness, molding, and the dissolving of the gelatinous coating of the shell, which would allow more rapid evaporation later and permit the easy entrance of bacteria. Eggs that have become wet accidentally should be placed in a well-ventilated, cool place, where they will dry well before being packed.

The factors responsible for the development of molds on eggs are plenty of moisture, warm temperature, presence of air, lack of ventilation, and sufficient food material. Mold will rarely start unless there is moisture on the surface of the egg, such as is caused by slight sweating, a broken shell, or contact with damp straw; but after mold has started it will obtain enough moisture and air from the inside of the egg to continue growth, except under very adverse conditions. This development often occurs around the air cell, where both air and moisture are available (Plate IV, 5 and 6). The molds occurring most commonly on eggs develop best at a temperature of about 70° to 100° F., the development decreasing beyond each limit until it almost stops at 32° and about 140° F.

Eggs that have been molded retain the pungent odor and unpalatable flavor of mustiness after the mold is destroyed, and can be used only for tanning purposes. Many persons cannot detect mustiness of raw eggs, especially in its early stages. Neither the opened nor the candled appearance of the egg is changed by mustiness; it can be detected only by the odor or the flavor, and since in some instances the odor cannot be detected, a musty egg may be shipped to the consumer without the farmer's suspecting it. The disagreeable odor and flavor of a musty egg is greatly increased when it is heated. Altho one musty egg among several hundred good ones may not be detected while in the shell or when opened raw, when such an egg is used in cooking the pungent odor and flavor will pervade a whole mixture and make it absolutely worthless. Mustiness is apparently the direct result of mold growth, and great care should be taken to see that there is no possibility of this trouble.

ABSORPTION OF ODORS AND FLAVORS

Eggs readily absorb odors and flavors of all sorts while they are being held, especially if the air is motionless, moist and warm, or fluctuating



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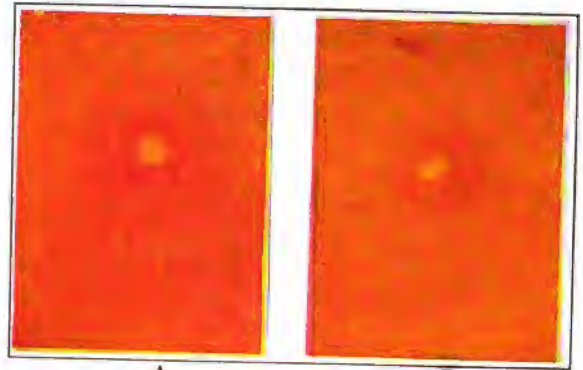

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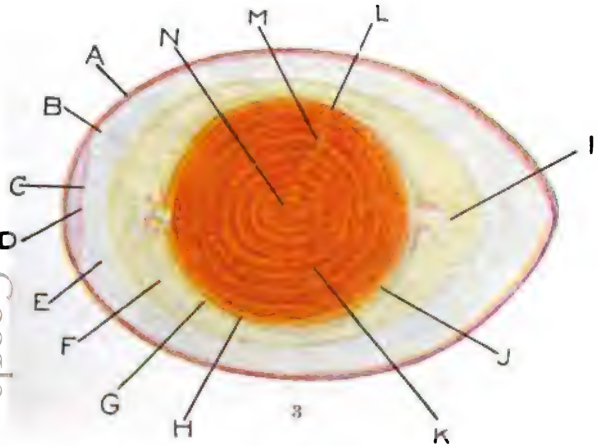

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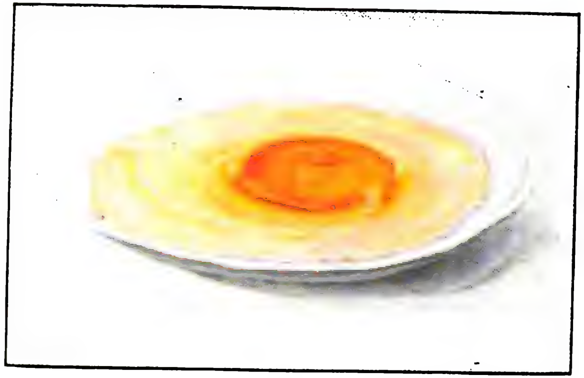

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PLATE I. STRUCTURE AND OPENED APPEARANCE OF EGGS

1. A new-laid egg. The yolk is rounded and firm, but the color may be dark or light yellow, or it may be slightly mottled, depending on the feed and the characteristics of the hen. The egg white is practically colorless, and a large portion of it of jelly-like consistency stands up around the yolk. The chalaza is distinct and closely twisted. The egg is nearly odorless

2. Germinal disks of new-laid fertile and infertile eggs. A, Disk of fertile egg. The central light-colored area has a definite circular boundary. The dark rings around the germinal disk may or may not be conspicuous. B. Disk of infertile egg. The boundary of the central light-colored area is indefinite and irregular. Dark rings are sometimes noticeable around the infertile germinal disk, but they are not usually quite so conspicuous as those around the fertile disk

3. Cross section of a hard boiled egg. A, brown shell; B, outer shell membrane; C, inner membrane; D, air cell; E, outer watery portion of albumen; F, middle jelly-like portion of albumen; G, inner dense layer of albumen; H, vitelline membrane; I, chalazae; J, thin film of white yolk inside of vitelline membrane; K, layers of yellow yolk separated by thin layers of white yolk; L, germinal disk; M, slender tube connecting center of yolk with region of germinal disk; N, central part of the yolk filled with white yolk.

4. Live embryo after twelve hours of incubation. There are distinct rings around the germinal disk, the yolk is flattened, the egg white is watery and darkened, and the chalaza is less distinct than in the new-laid egg. A slight odor can often be detected in such eggs


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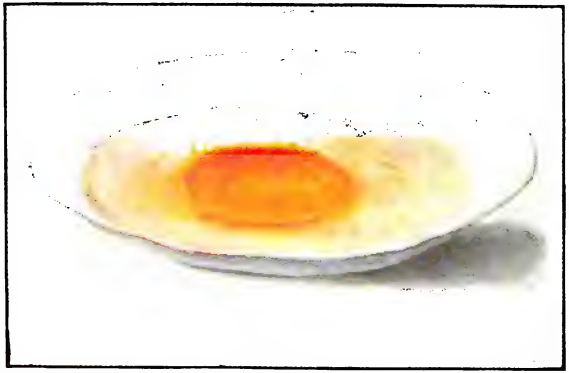
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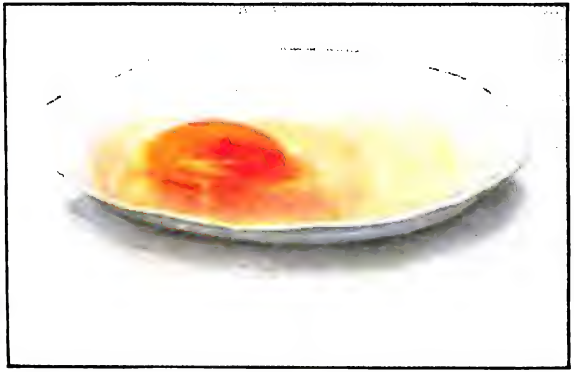
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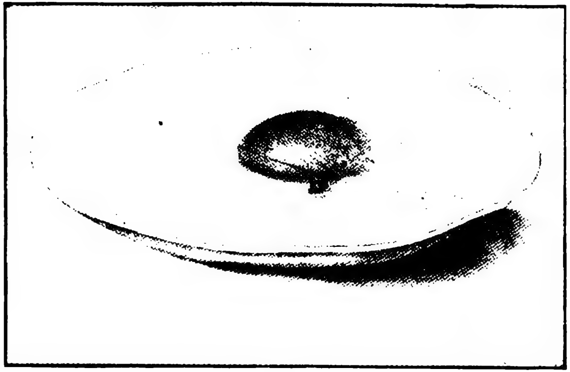
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PLATE II. OPENED APPEARANCE OF EGGS

1. Live embryo after five days of incubation. Note the embryo and the blood vessels, the ruptured vitelline membrane, and the watery nature of the egg white
2. Infertile egg after five days of incubation. The vitelline membrane is very weak, and the egg white very watery. A distinct yellowish green tint usually appears in the egg white, and an odor is perceptible
3. Bloody egg with blood clot adhering to the yolk. Some of the blood has become diffused thru a portion of the egg white
4. Egg with meat spot. The meat spot floating in the egg white resembles a piece of liver

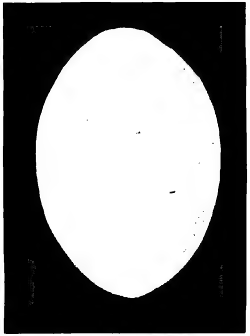

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PLATE III. CANDLED APPEARANCE OF EGGS

1. New-laid egg with white shell. The air cell is small, the yolk is indistinct, the egg white appears pink, and there is a slight shadow with accompanying reflection of light caused by the chalaza just above and to the left of the yolk

2. New-laid egg with brown shell. The air cell is small, the contents appear darkened, and the yolk is very indistinct

3. Egg slightly heated and evaporated due to poor methods of holding. The air cell is enlarged, the yolk appears as a more distinct shadow than in the new-laid egg, and the whole contents appear slightly darkened

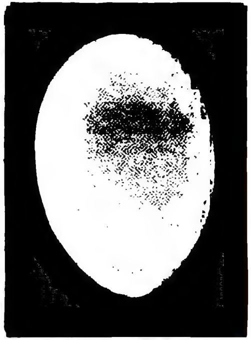
4. Egg badly evaporated and heated. The air cell is large, the yolk is distinctly darkened, and the whole contents appear darkened. The egg white has become so watery that the yolk is not held in the center of the egg and when it is candled usually appears near the section of the shell that has been on the upper side of the egg just previous to being candled

5. Bloody egg with blood clot. Note the bright red clot on the yolk, and the general redness of the egg white resulting from the blood diffused thru it

6. Egg with meat spot. The distinct dark speck floating in the egg white is a meat spot. In this egg the chalaza can be distinctly seen above and at the left of the meat spot; it appears as a white spot

7. Checked egg. The shell is broken, but there is no leaking of contents. The air cell is enlarged

8. Baked egg. Such an appearance may result if eggs are exposed to a temperature of about 140° F. or more



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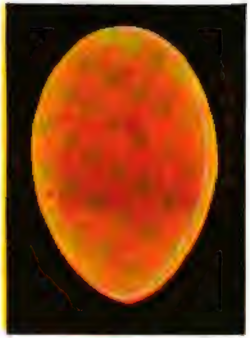

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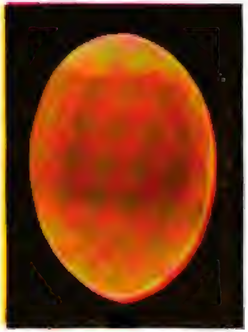

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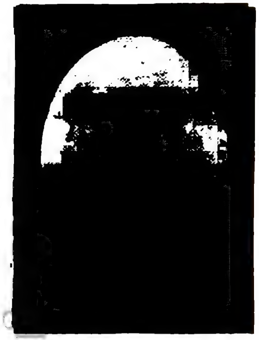

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PLATE IV. CANDLED APPEARANCE OF EGGS

1. Live embryo after twelve hours of incubation. The yolk is slightly raised and darkened by heat; the embryo is visible on the upper surface of the yolk

2. Live embryo after five days of incubation. The yolk is distinctly darkened, and the embryo and the blood vessels are very conspicuous

3. Dead embryo after five days of incubation. The air cell is enlarged, the egg appears clouded, and there is a ring or band of blood

4. Infertile egg after five days of incubation. The yolk is distinct, and the enlarged air cell has a darkened boundary. No development of the germinal disk is visible

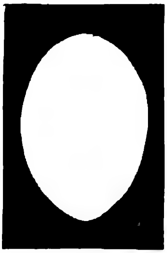
5. Egg with stuck yolk and mold spots. If the yolk is allowed to stick to the shell, mold usually develops

6. Egg with small mold spots. Such a condition results when an egg is held in too moist and too warm an atmosphere

7. Egg in which white rot has developed. The egg contents appear slimy and mixed

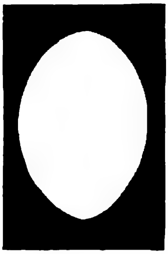
8. Egg in which mixed rot has developed. The contents in such an egg gradually darken until they become black

RATE OF EVAPORATION OF EGGS HELD AT 70° F. (ROOM TEMPERATURE)



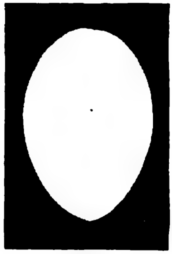
1

Egg held for one day



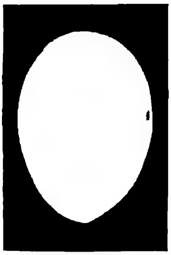
2

Egg held for one week



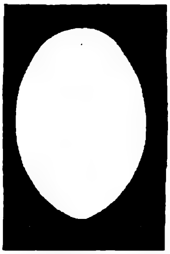
3

Egg held for two weeks



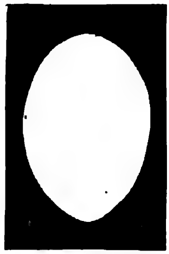
4

Egg held for three weeks



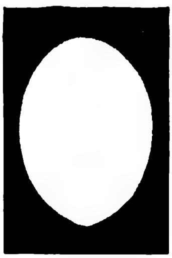
5

Egg held for four weeks



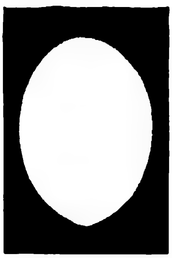
6

Egg held for five weeks



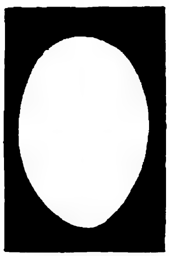
7

Egg held for six weeks



8

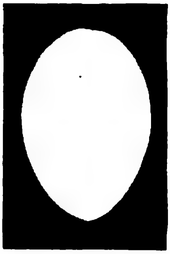
Egg held for seven weeks



9

Egg held for eight weeks

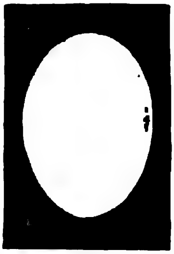
RATE OF EVAPORATION OF EGGS HELD AT DIFFERENT TEMPERATURES



1

Egg held for
one-half week at 40° F.

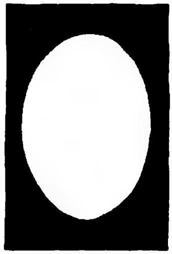
This egg is practically new-laid as to quality



2

Egg held for
one week at 40° F.

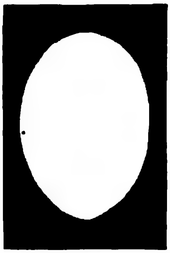
Scarcely any evaporation occurs before three or four weeks



3

Egg held for
twelve weeks at 40° F.

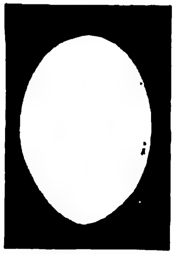
This egg is badly evaporated but not otherwise injured



4

Egg held for
two and one-half weeks at 50° F.

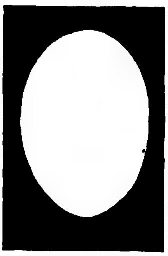
Cool, moist air prevents rapid evaporation and preserves the food value. Eggs should not be held as long as this



5

Egg held for
five weeks at 50° F.

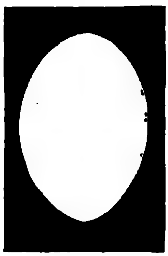
This egg has been held too long: the good conditions under which it was held are responsible for its good quality



6

Egg held for
six weeks at 50° F.

This egg has a porous shell, permitting rapid evaporation of the contents



7

Egg held for
six weeks at 50° F.

The dense shell of this egg prevents more than a normal rate of evaporation. As eggs become older the rate of evaporation increases

in temperature. While eggs are cooling, air is drawn thru the shell into the air cell. Odors and flavors are absorbed even more readily then than at other times. Care must be taken to avoid such odors as those of filth, mold, disinfectants, decaying vegetables, foul and stagnant water. Apples, quinces, oranges, or other fruits are often known to impart odors and flavors to eggs. These odors and flavors are sometimes lost in cooking, but they often persist, and are occasionally intensified by the heating and become decidedly offensive.

ROUGH HANDLING

Rough handling of eggs is sure to cause some deterioration even if the shells are not broken. If the air cell is enlarged by evaporation, rough handling will cause the two membranes to split apart beyond the edges of the cell. This will allow the air cell to move slightly as the egg is turned to one side or the other while candling. If an egg with a loose air cell is very roughly handled, the inner shell membrane may become ruptured and the air cell become a free floating air bubble in the egg.

FIG. 79. VARIATION IN THE SIZE AND THE SHAPE OF EGGS GATHERED IN ONE DAY

1, egg weighing $2\frac{1}{8}$ ounces; 2, egg weighing 1 15/16 ounces; 3, egg weighing $1\frac{3}{4}$ ounces; 4, egg weighing $1\frac{1}{8}$ ounces; 5, this egg is so small and narrow that it would lie lengthwise in the filler if shipped; 6, this egg is so long that it would be mashed during shipment

For purpose of identification on the market, broken eggs are designated as *checks* and *leakers*. Checks are those that are only slightly cracked and the contents of which are not leaking. Such eggs are not a total loss, but because they will deteriorate very rapidly they should be consumed immediately. Eggs that are only slightly checked are very hard to detect, except by candling or by clicking two eggs together. The latter method, however, requires skill and should not be depended on if the eggs are to be candled. Eggs from which the contents are leaking, known as leakers, are often a total loss. The contents of such eggs may become smeared on other eggs, begin to decompose, and cause deterioration.

DIRTY EGGS

Eggs frequently become soiled or stained by mud, filth, breakage of other eggs, wet nest material, and the like. Dirty eggs are undesirable because the large number of bacteria present in the filth will enter whenever the shells become moist, because the eggs readily absorb flavors and odors from the filth, because molds are likely to form on them, and because they are less salable than clean eggs.

GATHERING EGGS

Eggs should be removed from the nests as soon as possible after they are laid, and placed under more favorable conditions in order to prevent them from becoming heated, freezing, evaporating, becoming moist, absorbing odors and flavors, breaking, and becoming dirty. Eggs should be gathered at least once daily, and oftener when there is any danger of their being injured if left in the nests.

The nests often reach a temperature above that of incubation, during hot days or even during relatively cool days if the sun shines brightly. Nests should be constructed so that the sun cannot reach any part of them, and so that there will be a good circulation of air not directly in contact with the eggs.

A B

FIG. 80. GRADED AND UNGRADED EGGS

A, the small and abnormally shaped eggs were taken out of these; B, no attempt was made to grade these eggs. Some of them are so large that they would be broken during shipment; others are so small that they do not stand up well in the fillers

If fertile eggs that have been injured by heating are removed from the nest, cooled, and marketed properly, a considerable number of them will probably reach the consumers in edible condition tho some loss in quality is apparent. Allowing too many eggs to accumulate in the nest or leaving them too long ungathered tends to increase the number of broken and dirty eggs, which are due chiefly to overcrowding in the nests. Ordinarily, with good nesting material, four eggs in a single nest is enough; if there are more, the nests should be increased in number or rearranged. One nest for each six hens is about the right proportion.

If the eggs are merely stained or soiled by only a small amount of matter that has dried quickly and left no odor, they will reach the market in better condition if they are left uncleaned until just before shipment; but if the fecal matter on them is still moist or if a distinct odor is noted, they should be set aside when they are gathered, cleaned, and used within a few days. Cleaning eggs hastens deterioration. Dirty eggs should not be placed in the fillers of egg cases or in any other package to be used for shipping, as the packages may thereby be soiled or may absorb odors that will later contaminate clean eggs.

Checks that are noticed and leakers should be separated from the rest of the eggs when gathered, and either used at home or sold for immediate consumption.

RECEPTACLES

A ten-quart pail of heavy tin or galvanized iron with a little straw or excelsior in the bottom is one of the best receptacles to use in gathering eggs, for the following reasons: A heavy pail is rigid when it is lifted, and the weight of the eggs does not cause the sides to draw together and crowd the eggs as is so likely to happen when using baskets or other flexible receptacles (fig. 73); a pail is much less liable to give way in some part than a basket; a pail may be readily and thoroly cleaned if it is smeared by a broken egg, or if it becomes otherwise befouled; it is often inconvenient and undesirable to pack eggs immediately for shipment, and a pail allows ventilation, prevents rapid evaporation, and does not hold moisture nor become musty; the weight of a pail full of eggs (fifteen to twenty pounds) is not excessive, and the pail is not so wide that it strikes against the body while being carried, thus causing breakage of the eggs; pails are so generally convenient on a farm that a dozen or more may be used for other purposes besides gathering eggs, and consequently plenty of available receptacles can be kept on hand without special expense. Heavy water or milk pails that have become leaky will render years of service as egg receptacles.

FIG. 81. A SUITABLE SCALE FOR GRADING EGGS BY WEIGHT

This reads from zero to four ounces in sixteenths of an ounce. Lines have been inked on the scale bar at $1\frac{7}{8}$ ounces, 2 1/16 ounces, and $2\frac{3}{8}$ ounces, to indicate the proper reading for eggs weighing $1\frac{3}{4}$ ounces, 1 15/16 cunces, and $2\frac{1}{4}$ ounces, respectively, plus the weight of the ring for supporting the egg ($\frac{1}{8}$ ounce). These lines mark the minimum weights for Grades XXX, XX, and X

HOLDING EGGS FOR SHIPMENT

If the eggs are to be candled or graded, they should be left untouched in the receptacles in which they were gathered until just previous to shipment so that one handling will be saved and no unnecessary length of time will elapse between handling and consumption. The ideal temperature for the holding room is 40° to 60° F., and arrangements should be made whereby this temperature can be approximately maintained. If a cool room for storing eggs is not available, they may be kept under a frame covered by a wet cloth (fig. 74). Care should be taken to prevent

leakage of moisture on the eggs, and sufficient ventilation should be allowed to prevent mustiness.

It is impossible to state the best relative humidity at which to hold eggs for shipment, but this should be determined by trial. The humidity of the air in a room can be increased by setting pans of water about or by sprinkling the floor with water. In warm weather if outside air is allowed to enter a cool room or cellar, the walls and floor often become wet, due to condensation of moisture on them; under such conditions the whole room will become very moist. The humidity may be decreased by spreading any absorbent, such as lime, on the floor or in boxes. Also if the humidity is too great, on days when the outside air is cooler and drier than that indoors, the room should be ventilated by means of the windows. If a rapid circulation of air or a draft is unavoidable, the eggs should be set to one side so that a direct current will not blow on them and cause evaporation, and yet so that the air surrounding them will be fresh. Moderate and continuous ventilation of a room or a cellar will prevent the development of molds. A small open window covered by a cloth curtain is usually a satisfactory solution of this problem (fig. 75).

The humidity of the air can be accurately determined by the use of a hygrometer. A common and very satisfactory style for use by poultrymen is the combination wet and dry bulb hygrometer (fig. 76). By reading both thermometers and referring to a table, the humidity is obtained in terms of the percentage of the total amount required for complete saturation. Such hygrometers with full directions for use may be purchased from any scientific instrument company.

Under the conditions desirable for holding eggs for shipment, they seem to be especially susceptible to the absorption of odors and flavors, even more so than in the nest. The air is moist, is not moving rapidly, and the eggs are often held for several days. If the temperature of the holding room fluctuates frequently, the danger that the eggs will become tainted is increased. The room must be kept sweet and clean. Quicklime scattered on the floor and in any places causing trouble, will usually eliminate undesirable odors; a coat of whitewash will also help. Any deterioration of the eggs started while they were in the nests will continue thruout the period of holding, even tho conditions are ideal. Holding eggs for a long time even under the best conditions, will cause them to change somewhat, due to aging alone.

CANDLING

The method of preparing eggs for shipment depends entirely on the type of customers to whom they are to be sold. Country buyers may come to the farm and take the eggs unsorted and unpacked; but if they

are to be shipped direct to distant consumers, they must be packed and it may be necessary to candle them and sort them for size, color, and shell condition, according to the demands of the customers. With the small number of eggs produced on a single farm, the operations of candling, sorting for size, color, and shell condition, and packing may all be done at one handling, and the soiled eggs cleaned at the same time.

If a poultryman wishes to guarantee that every egg he sells is of fancy interior quality, he has no alternative but to candle all eggs before shipment. In some sections it is unlawful to sell eggs containing more than five per cent of rots. By care on the farm the proportionate number of eggs that are of poor interior quality can be reduced almost to zero, but that care, of course, cannot always be given.

Specific terms to indicate the quality of eggs must be adopted. In the present accepted meaning, the term *fresh* has no special significance with regard to the exact age or the exact quality of an egg. *Fresh* means now and may well continue to mean a condition of relative newness or not preserved, and may be used in describing a grade of eggs, but not as the name of the grade. There are many degrees of freshness. The following new specific terms are suggested: Quality A, Quality B, and Quality C. Poorer qualities than these are not classified here.

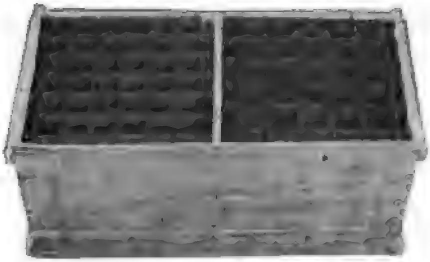


FIG. 82. TWO SIZES OF FILLERS

A, common egg filler; B, duck egg filler. The latter holds twenty-five eggs and may be used for shipping hatching eggs or very large market eggs

The following descriptions show the conditions of evaporation and heating to be considered in determining the qualities of market eggs. The worst faults determine the quality; that is, if an egg is of Quality A in evaporation but of Quality B in heating, it should be classed as Quality B, and vice versa.

QUALITY A

The diameter of the air cell of a normal one and fifteen-sixteenths ounce egg of Quality A shall be not greater than eleven-sixteenths inch. This is about the amount of evaporation shown in Plate V, 2, which represents an egg held for one week under relatively moist conditions. By using ordinary outside calipers and a ruler, as illustrated in figure 78, the size of the air cell can be easily obtained. If the air cell is not circular, the average diameter should be measured; if the edges are loose, only the size of the space actually filled with air should be measured. A specimen egg

conforming to this description may be selected; then after once carefully noting the appearance of this specimen, the candler will have a better idea of the quality wanted than if he tries to depend on this description. He should use his judgment in estimating the equivalent relative sizes of air cells to be allowed for different sizes or shapes of eggs. If an egg is larger or broader than the average, the air cell can be correspondingly larger.

A week is longer than eggs can be held under ordinary farm conditions and still pass for Quality A. The boundary of the air cell must be light colored and firm. In order to be considered of Quality A an egg must have the appearance of being practically new laid. There must be no indication whatever of any heating, such as is shown by darkening of the yolk. The egg must appear very much the same as that shown in Plate III, 1. The yolk sometimes casts a slightly darker shadow due to the fact that the eggs are at slightly higher temperatures at the time of candling, or due to feed. Absolute freedom from all blood clots, meat spots, or other defects is required.

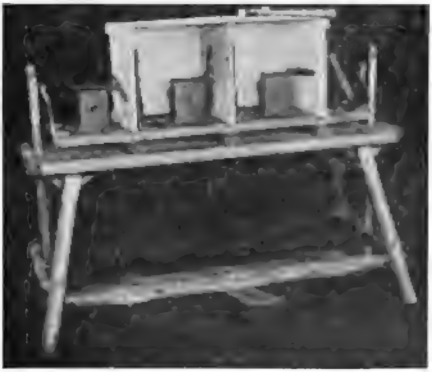


FIG. 83. EGG CASE MACHINE
This holds the parts of the case while they are being nailed together

QUALITY B

For a normal one and fifteen-sixteenths ounce egg of Quality B the diameter of the air cell shall be not greater than fifteen-sixteenths inch. This is an amount of evaporation about midway between the conditions illustrated in Plate V, 3 and 4. The boundary of the air cell must be fairly light colored but may be slightly loosened. The egg must appear to have a reasonably firm white.

An egg of Quality B may vary from the condition shown in Plate III, 1, to that shown in Plate III, 3. The yolk may appear as an indistinct shadow, must be light and free moving, and must not bear any other indications of heating.

QUALITY C

The diameter of the air cell of a normal one and fifteen-sixteenths ounce egg of Quality C shall be not greater than one and one-eighth inches. This is about equivalent to the condition illustrated in Plate V, 5. The boundary of the air cell must be fairly light colored, but may be slightly loosened. The egg may have a slightly weakened white, but should not be watery.

An egg of Quality C should be of a condition about midway between that shown in Plate III, 3, and that shown in Plate III, 4. The yolk may appear as a distinct shadow, but must not be distinctly dark or opaque. No darkening of the germinal disk should appear when candling; if it does, the egg is of course useless for food purposes.

SORTING ACCORDING TO OUTSIDE CHARACTERS

Eggs are often sorted according to size, color, shell outline, and shell condition including soundness and cleanliness, while being candled, but this cannot be done so conveniently and usually so accurately in a darkened room as in daylight. A daylight candler is very satisfactory on this account. In making up the market grades, the various qualities obtained by the sorting are combined with the interior qualities resulting from evaporation and heating, but they are considered separately here for the sake of an easier analysis of the principles on which market grading is based.

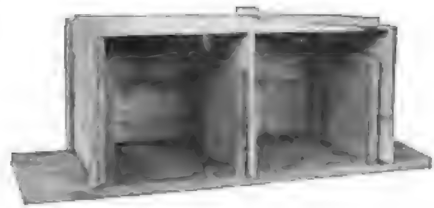


FIG. 84. A HOMEMADE FORM FOR USE IN MAKING EGG CASES

The work done with this form is not quite so rapid as with the egg case machine, but such a form is satisfactory for home use

SIZE

The size of market eggs is usually determined by weight per individual egg, per dozen, or per thirty dozen. In rare instances the size is determined by the width of the egg. Some hotel stewards have a ring of a certain diameter, usually about one and one-half inches, and eggs that will pass thru this ring are considered too small. Measuring eggs as a test for size is not so satisfactory as weighing, because of the great variation in shape.

The selling of eggs by weight has often been urged but has never been put into operation because of the difficult problems in the retail trade of selling exact weights. There is a strong tendency, however, to standardize the various grades on the market according to average weight or to eliminate those that are under weight. The ungraded case shown in figure 80, B, has a few large eggs, some too large, but it has many so small that they lie lengthwise in the compartments of the filler; these are called *sleepers* on the market. Some bakers and cooks are using canned frozen eggs or egg powder rather than shell eggs, because of the irregularity in size of the latter, which is very bothersome when following recipes. Eggs vary in size from about one and one-quarter to two and one-half ounces each (fig. 79). A grade of eggs from which all small ones are eliminated is very satisfactory to most customers.

A convenient scale, reading from zero to four ounces and graduated to sixteenths of an ounce, for grading eggs by weight is available on the market (figure 81).[1] A ring to support the egg is furnished with the scale, but it is balanced so that it reads zero without the ring on the platform; it may also be used as a postal scale. Any light-weight ring about one and one-half inches in diameter and one-half inch high, will be satisfactory.

The average weight of eggs is usually given by wholesale dealers as the gross weight of a thirty-dozen case. In order to find the net weight, twelve pounds is customarily subtracted; but to be accurate, several complete cases of the type being used should be weighed as a trial. Many cases, especially secondhand ones, weigh considerably more or less than the standard. The net weights for thirty-dozen cases, instead of gross weights, are at present used in all official wholesale grading.

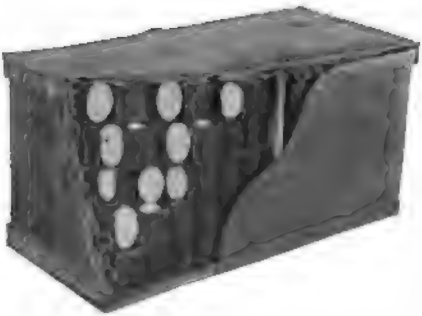


FIG. 85. SECTION OF A CASE PROPERLY PACKED FOR SHIPPING
All eggs should stand up well in the fillers

A series of grades determined by the smallest eggs allowed in them, as well as by the average weights, is here suggested. Eggs of Grade XX or XXX from which Grade X has been removed, will not be so good as such a grade from which none have been removed, but this can be made clear to the customer by the necessary explanations which must be made when selling the eggs. Eggs too large for the fillers used should not be included in any grade, as they will invariably become broken during transit.

GRADE X

Grade X eggs shall weigh not less than $2\frac{1}{8}$ ounces each and average not less than $62\frac{1}{2}$ pounds gross weight, or $50\frac{1}{2}$ pounds net weight per thirty-dozen case, or 27 ounces per dozen. Most farm flocks produce only a few eggs as large as this grade requires; but if there is sufficient demand, it may pay to make such a grade. Duck egg fillers (fig. 82, B) are sometimes used in packing Grade X eggs, or a few eggs of this size may be scattered thru a case with other eggs if care is used in placing them in corner compartments or between smaller eggs.

GRADE XX

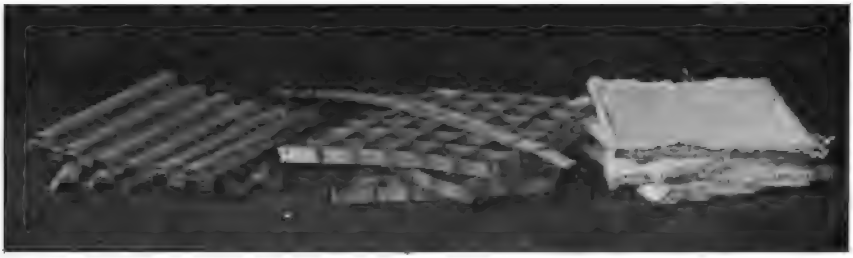
Grade XX eggs shall weigh not less than $1\frac{15}{16}$ ounces each and average not less than 57 pounds gross weight, or 45 pounds net weight per thirty-

[1] This scale complete with the cardboard egg ring may be bought from the Cornell Cooperative Society, Ithaca, New York. The retail price at present is 85 cents postpaid to any part of New York State.

dozen case, or 24 ounces per dozen. This is a good, acceptable grade of eggs, above the average on the market, and not so large but that any producer can so select his flock that a large proportion of the eggs will be included. These eggs if of normal shape will just fill the compartments of the standard egg case fillers (fig. 82, A). Even if some eggs are above the minimum weight for Grade XX, they should not be included unless they stand up reasonably well, as shown in figure 80, A.

GRADE XXX

Grade XXX eggs shall weigh not less than 1¾ ounces each and average not less than 53¼ pounds gross weight, or 41¼ pounds net weight per thirty-dozen case, or 22 ounces per dozen. An egg weighing 1¾ ounces (fig. 79) is a distinctly small egg.



A B C

Fig. 86. TYPES OF CUSHIONS USED IN PACKING EGGS

A, corrugated flats to use instead of excelsior padding on top of the case; B, ¾-inch fillers to use instead of excelsior padding in the bottom of the case; C, excelsior pads to use either on top or in the bottom of the case

GRADE XXXX

The size of individual eggs of Grade XXXX is not limited, but they shall average not less than 47½ pounds gross weight, or 35½ pounds net weight per thirty-dozen case, or 19 ounces per dozen.

COLOR

It is often desirable to grade eggs according to color if enough are available to make distinct grades in sufficient quantity to sell. Such grading is preferable for eggs of high quality and for those that are to be served in the shell. The white eggs should be closely graded for a market preferring that color, while the browns may all be grouped into one grade, and vice versa. A forenoon light from the north is best for grading eggs according to color; sunlight is very unsatisfactory. The following grades are offered as suggestions:

FANCY WHITE

In order to be classed as fancy white, eggs must be chalk white or slightly pinkish white, with no distinct tint of creaminess.

WHITE

A tint of creaminess or a slight mottling is allowed in eggs classed as white, but they must be distinctly white rather than brown.

FANCY BROWN

Fancy brown eggs must be dark uniform brown. Slight mottling may appear, but it must not detract from the uniform brown color.

BROWN

Different shades of brown may be included under brown, but the eggs must be distinctly brown rather than white.

FIG. 87. RETURNABLE CASE
This type of case is sometimes used for special trades

SHELL OUTLINE

All sorts of variations from the normal shape (fig. 77) are found in the eggs gathered during a single day (fig. 79). The grade of an egg is not affected by the shape unless it is extremely abnormal. Such eggs as 4 and 6 in figure 79 should be placed in a grade lower than that in which they would normally be. Slight bulges in the shell, ordinary creases, moderate wrinkles or roughness, are not sufficient to exclude eggs from their normal grade. The principal difficulty in selling eggs of abnormal shapes is that they do not fit the standard fillers and consequently present a very bad appearance and are likely to become broken (fig. 80).

SHELL CONDITION

In order to be classed in the grades described for interior quality, size, and color, eggs must be sound and clean. Checks and leakers should be sold separately as already explained. If the dirty eggs are of a grade better than Quality C and Grade XXX, it will certainly pay to clean them; whether it will pay to clean eggs of a lower grade depends entirely on the customers served.

If the dirt has not stained the shell, the egg can be easily cleaned with a coarse cloth wrung out of clean water. This will not wet the shell enough to injure the shell membranes. Stains may be removed with a moist cloth or brush and scouring soap or powder. Acids, such as vinegar, should not be used, as they are absorbed by the shell,

attack the lime, and seriously injure the keeping quality of the egg. The shell of an egg left in vinegar for a few hours becomes very thin; if the shell is left long enough, all the lime is dissolved and it becomes practically like that of a soft-shelled egg. For obvious reasons, any cleaning substances containing perfumes and having odors such as that of tar and ammonia, should be avoided. Most of the cleaning material should be wiped off but no attempt made to wipe the shells dry. The eggs should be then placed on a tray or in a receptacle where they will dry rapidly without being exposed to a dry wind. If the eggs are wiped dry after cleaning, some of the outer coating of the shells will be removed, thus producing a glossy appearance and increasing the possibility of evaporation and

FIG. 88. TYPES OF PACKAGES FOR PARCEL POST SHIPMENT

infection. These cleaned eggs may be included in the regular shipments, unless the customer especially requests otherwise, as might be the case if the eggs are to be placed in cold storage or kept for a considerable length of time before consumption.

If a large amount of dirt is deposited on the shell, it should be scraped off before it is moistened, for this saves time and avoids dirt on the cleaning cloth or brush. Eggs that are badly smeared with egg contents or other similarly adhesive material may have to be soaked before they can be cleaned. They should not be soaked longer than necessary, however, and should be cleaned by the method described. Such eggs should be sold for immediate consumption and the ones that were in the worst condition should be sold to customers who will closely inspect them before use.

PACKING

Aside from the question of breakage, on the average probably not less than ten per cent of the deterioration in the quality of eggs occurs during shipment. Such deterioration may be due to evaporation, heating, rapid changing of temperature, excessive moisture, and rough handling. New methods of packing are being tried continually in order to decrease the losses from such conditions.

PACKAGES

Up to 1892, eggs were received on the New York City market packed in kegs containing seventy dozen each. The more easily handled thirty-dozen case, however, rapidly increased in favor after its introduction at that time. To-day the most common packages for eggs are the standard thirty-dozen case, returnable cases, and innumerable styles of small packages.

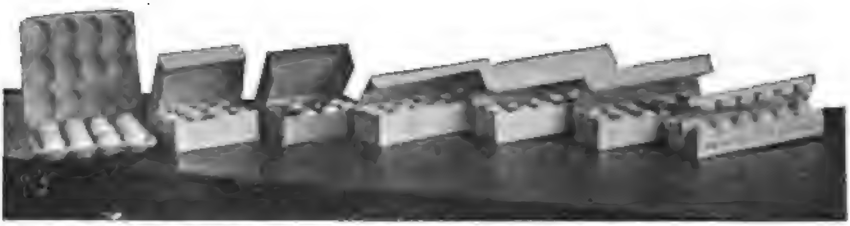


FIG. 89. PASTEBOARD CARTONS FOR EGGS

STANDARD THIRTY-DOZEN CASE

The outside dimensions of the standard thirty-dozen case are: 13 inches high, 12 inches wide, and 25 inches long. These cases are constructed of thin material. The sides, the top, and the bottom are $\frac{3}{16}$ inch thick, the partition and the ends $\frac{3}{8}$ inch thick, with a cleat $\frac{1}{2}$ inch by about $1\frac{1}{8}$ inches at the top and bottom of each end. Wood for such cases should be tough, non-warping, light colored, non-staining, odorless, light in weight, and low in price. Cottonwood, tupelo, and gum are commonly used and are mentioned in the order of their desirability.

The cases are usually shipped knocked down (K. D.) and must be made up by the shipper. A special egg-case machine (fig. 83) may be used for this purpose, or a frame may be constructed for use on a bench (fig. 84). Twopenny or threepenny cement-coated or resin-coated nails should be used. The coating causes the nails to hold to the wood better.

Fillers for thirty-dozen cases are either handmade or machine-made (M. M.) of the following grades: no. 1, weighing $3\frac{1}{4}$ to $3\frac{1}{2}$ pounds per set; special 3 pound; medium, weighing $2\frac{3}{4}$ pounds per set; and no. 2, weighing $2\frac{1}{2}$ pounds per set. The machine-made medium and special 3-pound

grades are the most popular for domestic use; no. 1 is sometimes required if the eggs are to be placed in cold storage or exported. The fillers and the division boards separating the fillers are made of hard calendered strawboard.

The pad under the bottom filler may consist of about one-half inch of excelsior, well smoothed out, and with a division board over it (fig. 85), or it may be one of the patented pads, such as the "excelsior wrapper," or a special three-quarter-inch cushion filler with a division board over it (fig. 86).

Some dealers return the used egg cases to their shippers; others sell them for a few cents or give them to companies that collect them regularly, repair them, and then resell them. Such cases, if in good condition, are

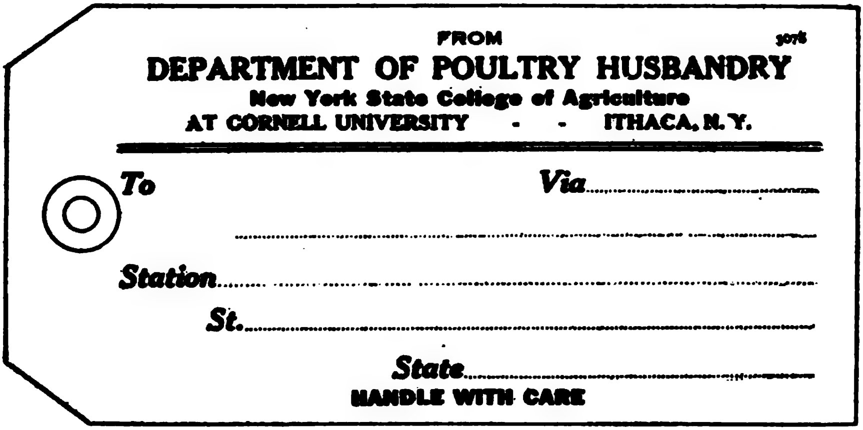


FIG. 90. A GOOD FORM OF SHIPPING TAG FOR GENERAL USE
Front and back are printed alike

entirely satisfactory. When using secondhand cases, some extra fillers and division boards should be kept on hand to replace broken ones. Secondhand cases used for express or freight shipments are sometimes required to be bound at each end on at least three sides by a band of metal or wood. Wire or strips of heavy tin or other strong metal three feet in length are sufficient to go around the bottom and both sides, and serve the purpose very satisfactorily. These strips may be bought cut to length or in rolls.

In transportation the fragile contents of a standard thirty-dozen case are instantly recognized. If from six to thirty dozen eggs are being shipped, the cost for the package and transportation will probably be less if they are in a standard case than if in a special package, and the care used in handling it is likely to be much better.

RETURNABLE CASES

Heavy cases to be returned to the shipper are sometimes used (fig. 87). Such cases are often locked and bear advertising material. They of course look well and may be desirable under certain circumstances, but weight, cost, even if repeatedly returned, and annoyance to the customer who returns them, are disadvantages hard to overcome. The breakage of the eggs is not reduced by their use, and most customers do not like them.

When eggs are collected from farms by grocery wagons or hucksters, cases of the heavy returnable type, called "wagon cases," are often used. These are sometimes equipped with patent fasteners.

SMALL PACKAGES

Small packages of innumerable designs for carrying eggs are on the market (fig. 88). Most of them are constructed for either express or parcel post use, but the cost of a small package of strong enough construction is often prohibitive. The package with the lowest first cost is not always cheapest in the end. The worth of any particular package may best be determined by actual trials.

In choosing a suitable style, special emphasis should be placed on convenience, protection, low cost, and serviceability. Corrugated cardboard is becoming a very popular material for the construction of either the outside or the inside. When wood is used for the outside, corrugated cardboard is often used inside as it is a very satisfactory shock absorber. Eggs for hatching are often packed in excelsior or other similar material in baskets. The advantage of the basket is that it is likely to be handled with great care and to be placed on top of other packages and never under them.

The postal authorities publish the following regulations at the present time as to types of packages acceptable for parcel post shipments:

> Eggs will be accepted for local delivery when so packed in a basket or other container as to prevent damage to other mail matter. Eggs will be accepted for mailing, regardless of distance, when each egg is wrapped separately and surrounded with excelsior, cotton or other suitable material, and packed in a container made of double corrugated pasteboard, metal, wood or other suitable material, in such manner as to place each egg on its end and to prevent them from striking together or against the side or top of the container, with an outer cover of double corrugated pasteboard, metal, wood or other material, and wrapped so that nothing can escape from the package. All such parcels must be labelled "Eggs."

Cartons holding one dozen eggs each are sometimes used, especially in retail trade (fig. 89). The compartments of the carton fillers are in most instances slightly smaller than those of the regular case fillers. Several different types of cartons have been designed, the 2x6-style being most commonly used. The essentials are convenience, protection, light weight, low cost, attractiveness, and advertising value. Staples are

better than glue for fastening the carton together because moisture is likely to cause the glue to loosen. The 2x6-style of carton may be packed in the thirty-dozen case and the same padding should be used at the bottom and the top as with regular fillers, but no division boards are needed between the layers. Gummed seals are often used to insure against fraud.

DIRECTIONS FOR PACKING

For packing eggs, the light should be good enough for grading, so that any defective eggs remaining may be noticed and removed. The top layer should be absolutely typical of the whole case. The poultryman should build up a reputation for putting out a uniform case of eggs so that inspection of the top layer is sufficient. The eggs should be packed with the large ends up. Every egg should fit fairly snugly in its compartment, and the filler should be held firmly against the side walls of the package. Any looseness of either the eggs or the fillers is likely to cause breakage and watery egg contents; on the other hand, if the eggs are crowded, breakage will result. Sometimes a little padding is needed to tighten the fillers in the case. Padding should never be placed on more than one side and one end of each half of the case; care must be taken not to crowd the eggs. The following is a convenient way to pad a case: Place a division board upright where the padding is needed; then after the case is filled or at intervals during the filling, force a very small amount of excelsior between the division board and the case with a thin paddle (fig. 85). By this method a more even pressure is exerted on all the fillers than if the division board is not used.

No musty nor moist fillers or packing materials should be used. If the filled packages are subjected to a change of temperature so that there is danger that the eggs will sweat, they should be immediately repacked into dry containers. In some instances it may be advisable to prevent damage from sudden changes of temperature by lining the case with paper. After the package is filled, a division board should be placed immediately over the eggs and enough excelsior added to make the contents press against the cover (fig. 85), and the case should be closed properly to protect the contents from dirt, air currents, and direct rays of the sun. The case should be securely fastened on all sides; carelessness in this regard is costly.

The package should be marked plainly with the name and address of the shipper and the receiver. A desirable form of shipping tag is shown in figure 90. If made of cardboard the tag should be tacked on the case; if made of paper it may be fastened to the case by an adhesive, such as the ordinary commercial solution of water glass. After the addressed tag has been glued to the case, it should be coated with water-

glass in order to prevent it from becoming blurred by rain or from being torn off easily. The tag on a thirty-dozen case should be placed on the end under the top cleat, as it is better protected there from damage than if placed on the exposed top of the case.

MEETING THE NEEDS OF CUSTOMERS

The particular quality of eggs to be sold to a customer depends on his needs. If there is a guaranteed standard, the quality sold should always be enough above that standard so that the producer is reasonably sure that every egg will be satisfactory. The consumer is concerned not with the quality of the eggs shipped but with the quality of the eggs consumed.

CUSTOMERS FOR MIXED QUALITIES

Such buyers as commission merchants and country buyers, who have the equipment for handling eggs of mixed qualities, can usually better afford to buy such eggs than to pay the farmer the extra amount that it costs him to produce eggs guaranteed to be of uniform quality. In such cases if the producer takes ordinary care of his eggs he is doing all that is expected, and all for which the trade is prepared to pay him. To these customers the eggs may be shipped uncandled and ungraded, unless the producer is interested in the quality for his own personal benefit. If, however, the wholesale dealer or other customer wishes only good eggs, he is glad to pay for a guarantee, and candling and grading for size, color, outline, and condition, become necessary. If candling is done, the producer should discard all unmarketable types of eggs, such as those that have large blood clots, large meat spots, developed germs, or stuck yolks, and those that are bloody, molded and musty, baked, frozen, or rotten. Candling on the farm should also serve to eliminate those eggs that are all right at that time, but that are liable to become unfit for use as food by the time they reach the consumers. The only grading to be done for these buyers ordinarily is the sorting out of very small eggs, such as those of Grade XXXX and possibly Grade XXX, and of certain off-colored ones if so requested.

CUSTOMERS FOR EGGS TO BE HELD AND RESOLD

Another group of customers includes wholesale receivers or jobbers in the country or the city who keep a stock of eggs on hand for their trade, those who wish certain grades for special trade, and those who wish eggs for cold storage or preservation in other ways. These customers require eggs good enough to withstand holding. If a producer is to satisfy these

customers who wish fresh farm eggs, he must maintain a high standard; otherwise they might better buy eggs of as good quality from another dealer at no higher and sometimes a lower price and with much greater convenience. All such eggs should be of Quality A, but relatively less attention is usually given to size and color. Great care should be used in discarding all eggs with imperfections, such as blood clots and meat spots, and with such minor indications of deterioration as loose air cells. At first in most cases the dealer will feel it necessary to candle the eggs again after they are received, but after the producer's reputation has been established beyond a doubt, the dealer may be saved this expense. Grade XX is the most commonly required size, altho size is often sacrificed for interior quality.

It is well known that the Boston market and consequently the surrounding New England markets pay considerably more for dark brown eggs than for white or mixed colors. The New York City market and the other markets relatively close to New York pay more for white-shelled eggs. This difference in price bids fair to continue to exist at least to some extent. Dealers of course have use for all these color grades, and the poultryman should obtain special instructions direct from them.

CUSTOMERS FOR EGGS FOR IMMEDIATE USE

For private consumers who wish fresh farm eggs and for those retail stores or other distributing agencies that deliver the eggs to consumers immediately after they are received, the interior quality of the eggs must be somewhat better than that actually needed at the time of consumption, but not necessarily so good as when they are to be held. Quality B would usually be satisfactory for such customers. Very likely, however, they would prefer to pay more if they could obtain a better quality. Hotels, restaurants, and hospitals, in which eggs are used within a few days after receipt, usually need at least two qualities: Quality A or B of Grade XX or sometimes Grade X, for serving on the table; a cheaper quality, such as C of smaller size, for baking purposes. Bakeries can also often use eggs of Quality C of any size. These buyers know exactly the quality of eggs needed for their business, and they do not have to guarantee them to a second buyer.

All customers who have to resell the eggs on the market, hotels and restaurants, which must meet the fancies of their patrons, and consumers who are willing to pay more for the sake of having just the color of eggs desired, are likely to discriminate between grades of color. Creamy and brown eggs can very often be sold for poaching, frying, or baking purposes, to the customer who uses fancy white for boiling, or vice versa.

CUSTOMERS FOR SPECIAL QUALITIES

Private families, small restaurant owners, bakers, and the like, who need good eggs, will often use the available frozen eggs, incubated infertile eggs, and those having meat spots and blood clots. Such customers will do much to save losses on the farm and at the same time will be receiving real service. A few private customers may wish to obtain Grade X eggs; on the other hand many will be glad to have Grade XXX or even Grade XXXX eggs if they are fresh.

The buyers of special qualities in small amounts are usually the best customers for eggs that are dirty, soft shelled, or cracked. Personal interviews and arrangements are usually necessary for a sale of such grades. If the eggs are not to be served in the shell, the customer will very often prefer to receive them dirty rather than to pay for the extra cost of cleaning them.

SHIPPING

Freight service is not designed for the transportation of less than wholesale amounts of perishable products except for special service to points not far apart. The temperature cannot be regulated nor the time of delivery determined satisfactorily. Express or parcel post service is planned for such work. The minimum rate for express makes it somewhat expensive to ship only a few dozen eggs, but the care given while in transit and the delivery service make it very well adapted to the poultryman's needs. For amounts of eggs up to about fifteen dozen that are to be sent no farther than the second zone, the parcel post service at present is in most cases cheaper than express and in many instances more convenient for the producer. The principal objections to this method of transportation are that refrigerated service is not rendered during warm weather, and that the parcel post packages are usually handled more roughly than express.

A common statement is that eggs should be shipped at least once each week. When eggs are kept under ordinary farm conditions one week is too long to hold them before shipment, but the conditions can be made such that eggs can be kept for that period and still be satisfactory to the market. Every hour intervening between the time eggs are laid and the time they are eaten, marks some deterioration in quality. If the farmer knows something of the market he is supplying, he will be helped in determining how long he should hold his eggs before shipment. For example, if the eggs are to be placed in cold storage, in water glass or any other preservative, or are to undergo hard handling or delays before reaching the consumer, special care should be taken to make shipments from the farm very soon after the eggs are laid.

Eggs should never be shipped so that the transportation agent is entrusted with keeping them over Sunday, unless the customer must receive them on Monday. Either the producer or the consumer should keep the eggs under conditions that are at least known. Tuesdays and Thursdays are considered favorable open market days; if a regular trade is established, any business day except Saturday is usually satisfactory.

If the time of transit to the market is such that either a day or a night must be spent en route, the night shipment is to be preferred for the following reasons: The cars are not usually opened so much during the night, and during the summer they are cooler at night. There are usually not so many products to be handled at the stations; therefore there is less danger of rough handling. Delivery is made early the following morning, which is much better than in the afternoon.

If eggs are shipped by express or freight, inquiry should be made at the station to learn the relative rates on shipments of different sizes. For points not far distant, a minimum charge is made for one case of eggs, while two cases are billed as exactly one hundred and six pounds, resulting in a lower charge per case. Fifty-three pounds gross per case is the estimated weight used in charging for transportation of eggs by freight and express.

It is usually good policy to prepay all transportation charges unless specific arrangements otherwise have been made with the customer; then the shipper has all his transactions with the local agent of the transportation company, and he can immediately correct any overcharges or mistakes.

Except in case of parcel post shipments, customers should be instructed to file all claims for breakage or other damages, such as freezing or missing eggs, with the transportation company immediately, so that inspection can be made and a fair basis for a claim established. It is estimated that about one-half dozen eggs in each thirty-dozen case become checked during normal transit, even if well packed. If the claims are just and are filed promptly, payment is usually obtained without difficulty.

Just so far as the producer is responsible, he should exert every possible influence to maintain the quality of his eggs and to hasten their trip to the customers. The particular methods employed will vary greatly with persons and circumstances. The determination and the effort to do the best one can with the equipment and conveniences available, will do much toward establishing an enviable reputation on the market. The poultryman who produces a superior product does not have to look long for a satisfactory customer.

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 133 | POULTRY SERIES | FEBRUARY, 1918

PREPARATION OF EGGS FOR MARKET

DISCUSSION PAPER

The discussion paper takes the place of the teacher in encouraging thought and self-expression on important points in the lesson, and aims to assist the reader in reviewing and applying them. Each discussion paper filled out and returned is read carefully, and a personal reply is made to questions on any agricultural subject. In order to continue a course, the reader should sign and return the discussion paper so that another lesson may be sent. Questions are included on the discussion paper for the purpose of assisting those readers who desire to give the lesson special study. The preparation of answers is optional.

The available reading course lessons for the farm are arranged in series on the following subjects: THE SOIL, FARM CROPS, LIVESTOCK, DAIRYING, FARM FORESTRY, FRUIT GROWING, PLANT BREEDING, THE HORSE, POULTRY, VEGETABLE GARDENING, FLOWER GROWING, COUNTRY LIFE. New readers may enroll in one or more of these subjects. The first lesson in the series is sent on enrollment, and subsequent lessons are sent, one at a time, on the return of discussion papers. The reader may register for the Poultry Series by signing and returning this discussion paper. The space below on this page is reserved for registration in other series, and also for names and addresses of residents of New York State likely to become interested in the reading course.

(Detach, sign, and return for the next lesson in this series.)

(In answering questions, attach additional paper if needed and number the answers.)

1. Open into saucers six supposedly fresh eggs that are to be used for cooking. Describe in what respects each varies from the description of the fresh egg given in this lesson.

2. Give all reasons why eggs should be gathered frequently.

3. What is a very good receptacle in which to gather eggs and why?

4. Describe the ideal place at your home in which to hold eggs for one week and give reasons.

5. Candle as many eggs as necessary until at least three eggs showing possible faults of new-laid eggs are found. How many eggs were candled before the three defective eggs were found? Describe the three eggs.

6. Candle as many eggs as necessary among those ready to be used or to be sold until some eggs of Qualities A, B, and C are found. Explain all that you know about the age of the eggs candled, the conditions under which they had been held, and give the relative number of eggs of each quality which have been candled before finding the three qualities wanted.

7. Describe Grade XXX of eggs. What can be done with the eggs that cannot be included in this grade?

8. Describe the methods of cleaning all kinds of dirty eggs.

9. Describe the standard case for wholesale shipments of eggs.

10. In what respects do express and parcel post service for egg shipents differ?

11. Describe the correct method of packing eggs for shipment.

12. What can be said relative to the best time of the day and best day of the week for making egg shipments?

Name..

Address...

Date..

(Address all correspondence to the Reading Course for the Farm, College of Agriculture, Ithaca, New York.)

THE CORNELL READING COURSE FOR THE FARM

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE
AT CORNELL UNIVERSITY, ITHACA, NEW YORK
A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 134 LIVESTOCK SERIES MARCH, 1918

STARTING A FLOCK OF SHEEP

MARK J. SMITH

SHEEPMEN IN THE MAKING

The best sheepmen are usually those who became interested in sheep husbandry early in life

Published and distributed in furtherance of the purposes provided for in the Act of Congress of May 8, 1914

THE CORNELL READING COURSE FOR THE FARM

SUPERVISOR
ROYAL GILKEY

EDITORS FOR THE COLLEGE
BRISTOW ADAMS
RUTH VAN DEMAN

" Upon the farmers of this country in large measure rests the fate of the war and of the nations."— PRESIDENT WILSON, April 15, 1917

Under war conditions the skillful work of the man on the land has become more important than ever before. There is indeed every reason for zeal in increasing food production. Knowledge will help to make labor productive. Abraham Lincoln once said, " No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought as agriculture." The College of Agriculture, thru the Reading Course for the Farm, offers twelve series of lessons for home study free to residents of New York State. The attached discussion paper gives details about these series. The reading course lessons are elementary and brief. Three advanced reading courses, in farm crops, fruit growing, and vegetable gardening, provide more complete instruction in accordance with modern correspondence methods.

In a number of communities groups have organized for the discussion and study of common problems, and have adopted the name Cornell Study Club. The primary purpose of a Cornell study club is to furnish an occasion and an incentive for discussing reading course lessons for the farm and for the farm home, but the objects include the accomplishment of local improvements, the encouraging of cooperative buying and selling, and the bringing of outside speakers into the community. Cornell study clubs are educational and social centers, and should develop local leadership and the human resources of the community. Assistance is given in organizing and conducting clubs, and speakers are sent to clubs occasionally in connection with the regular extension work of the College.

Correspondence is a medium for the exchange of helpful information. Letters will receive careful attention.

STARTING A FLOCK OF SHEEP

MARK J. SMITH

To the farmers of many sections of the Eastern States has come a renewed interest in small flocks of sheep. A generation ago, economic conditions forced them off of eastern farms; to-day other economic changes are bringing them back. In order that their return, where it seems desirable, may be hastened and that they may be thrifty and profitable, the beginner in the art of sheep husbandry should know certain facts; otherwise there will be much personal loss and discouragement and needless embarrassment to the industry. As farmers are studying their business more carefully, many are discovering that they have a place for a flock of sheep and are asking many questions. The most important of these are considered in this lesson.

Beginners in sheep husbandry should undertake it with a view to being engaged in it over a period of years. There has been too little stability and continuity in farm flock industry. Farmers have in too many cases gone into the business when prices were high only to become discouraged and sell out their flocks when the prices for sheep and sheep products assumed low levels. The men who kept their farm flocks thru both good and unfavorable prices are now reaping a rich harvest.

SIZE OF FLOCK

No kind of stock husbandry is better adapted for beginning in a moderate way than is farm flock husbandry. There is an old saying that "a man should grow into the sheep business and not go into it." It is good business as well as good common sense for most beginners to start on a rather small scale and increase the size of their flocks as experience is gained. First-hand study of sheep and their needs is the best practical guide. However, unless a farmer is so situated that he can handle a flock of twenty breeding ewes, it is questionable whether a smaller flock would be a sufficient factor in the farming scheme to justify the necessary care and attention.

Advocates of more sheep for eastern farms are divided by their beliefs into two groups: those who believe in the ownership of large flocks cared for by trained specialists, and those who believe in the ownership of small flocks on many farms as secondary to the general farming operations.

This lesson is written mainly for the farmer with little experience in sheep husbandry who is starting a small farm flock. Flocks of this type

will usually consist of less than one hundred ewes; however the principles here given are applicable to the larger enterprises.

SELECTION OF STOCK

Certain principles in the selection of stock are fundamental. Sheep are kept mainly for profit, and the farm flock industry is based on mutton production, with wool as an important by-product. At one time the sheep industry of New York State was on a wool basis, but increasing demands for meat have now placed it on a mutton basis. This is an important point in the selection of stock.

With the existing high prices of all feedstuffs, lamb production increases in profit in proportion to the ability of the ewes to give milk, for this largely determines the rate of growth of the lambs. The most economical way to feed a lamb is by feeding the ewe for milk production. The following qualities should be considered in selecting the farm ewe: constitution, size, health, soundness, fleece-covering, prolificacy, and a propensity to milk production.

The greater part of the income from a ewe is obtained thru the sale of the lamb; therefore a good utility ewe should show evidence of possessing a strong constitution and the ability to produce, deliver, and grow a robust lamb. These qualities are indicated by a wide conformation thruout, with sufficient length, a good heart girth, a strong back, and a roomy middle. The ewe should have capacity for feed and room for her vital organs. She should be well grown, because in addition to the need for sufficient size, the fact that a ewe during her early development was well fed and nourished will have a beneficial effect on her constitutional vigor and on her value as a breeding ewe. Breeding ewes that are short and plump should not be selected. Roominess is essential.

Health is a requirement that in importance is second to none, because after a flock of sheep has been established on the farm the success or the failure as well as the pleasure derived from them will be dependent mainly on the degree of health that it is possible to maintain in the flock. Great care should be exercised to see that only healthy sheep are bought. This is the first precaution that should be taken in preserving flock health. The characteristics of a healthy sheep are an alert carriage in which the head is held high, a bright eye, a pink skin, and a fleece that is elastic to the touch and appears lustrous rather than dull. In some breeds the skin, even in good health, is not so pink as in others. For example, the Hampshire Down breed has a tendency toward bluish skin, and in this case the color should not be given too much weight as an indication of ill health.

Ewes should be sound, and without doubt the two most important points to consider in this connection are the mouth and the milking organs. If young ewes are purchased, their mouths should be examined to see that the condition of the teeth conforms to the age the sheep are said to be. Until a sheep is four years old, its age can be told by the teeth accurately enough for all practical purposes. At about one year of age, the two middle incisors of the eight narrow milk, or baby, teeth are replaced by two larger, broader, permanent teeth. When the sheep is two years old, two more baby teeth are replaced by a permanent incisor on each side of the first pair of permanent teeth. By the end of two more years, all the baby teeth have been replaced by permanent teeth, and the sheep then has a full set of teeth. When a sheep is five years of age, the mouth is generally still sound; but after that age has been attained, some of the teeth are often lacking and those that remain become shorter and farther apart. Inexperienced persons will sometimes mistake a yearling or a two-year-old ewe that has lost some milk teeth and has not yet acquired the corresponding number of permanent teeth for an old ewe with a broken mouth, particularly if the sheep is in somewhat run-down condition. In some cases ewes may retain all their teeth until eight or more years of age. A peg-toothed ewe is one that still has most of her teeth, but they are worn in such a way as to resemble pegs. As a ewe advances in age, she gradually assumes a worn appearance and becomes emaciated. This condition, together with her broken mouth, serves as an accurate indication of her approach to the discard stage. Ewes vary greatly with regard to the rate of their decline after they have reached four years of age. Some ewes are more valuable at that age than others at two years of age, on a basis of prospective production of wool and lambs. The great deciding factor is the constitutional vitality of the ewe.

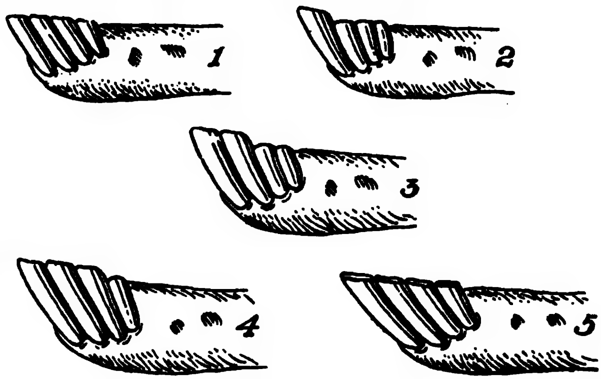


FIG. 91. DIAGRAM OF THE LOWER JAW OF A SHEEP AT DIFFERENT AGES

1, Lower jaw of a lamb; all baby teeth. 2, Lower jaw of a yearling; one pair of baby teeth has been replaced by a pair of larger and longer permanent incisors. 3, Lower jaw of a sheep two years old; two pairs of permanent incisors have developed. 4, Lower jaw of a sheep three years old; three pairs of permanent incisors have developed, leaving one baby tooth on each side. 5, Lower jaw of a sheep four years old; all permanent teeth

All ewes should be examined for soundness of their milking organs. Ewes with mutilated teats due to carelessness at shearing, with lumps in their udders, or with any other indications of past udder troubles should not be bought. Good milking ewes often have udder troubles, if neglected, due to an excess of milk at the time when the lamb is too small to take all of it. Such ewes should not be added to the flock, altho a real shepherd would do well to buy ewe lambs from these ewes.

The present and prospective wool situation justifies the insistence that the ewes bought have dense coats of marketable wool. The staple should be of good length, and the number of fibers to the square inch should be as great as possible. The wool from a flock of ewes should, in the main if not entirely, pay for the upkeep of the flock thruout the year. The best wool grows on the shoulders of the sheep and the poorer grade on the underside of the body, around the tail and the head, and down the hind legs. The wool should be, to as great a degree as possible, uniform over the entire body. This is especially desirable in sheep of fine wool breeding.

That twinning is a tendency transmitted from the ewes to the ewe lambs, is a reasonably well-established fact. Therefore ewes or ewe lambs that are out of twinning mothers should be selected. In the case of well-cared-for flocks, twin lambs are more profitable than singles. Prolificacy and propensity to milk production are likely to accompany each other, and it is right that they should.

Another quality to look for in the breeding ewe is femininity, a quality very desirable in all female breeding stock and one that is very hard to define. It is the absence of coarseness, and it imparts the appearance of refinement to the ewe. It should not, however, be present to the point of delicacy.

Uniformity of breeding, size, age, and markings is essential, as it will have direct bearing on the uniformity of the lambs. If possible to avoid it, a promiscuously bred flock of sheep should not be bought. However, if the price is low enough to warrant their purchase, they can of course be greatly improved in a generation or two by the use of a purebred ram.

TYPES OF SHEEP

What is the best breed of sheep, is very often asked. There is no best breed. The modern breeds of sheep have been developed in most cases for special purposes and conditions; examples of this are the leading mutton breeds.

The person who is making a breed selection should study the market demands and the adaptation of the various breeds to the conditions

at the farm on which the flock will be kept. He should then select the breed that seems most nearly to fill the requirements and the one for which he has a personal liking.

Whether the farm is rather level or extremely rough should be taken into consideration. For instance, sheep of the large, long-wool breeds, such as the Lincoln, the Cotswold, and the Romney Marsh, would be ill adapted to a very hilly farm. The Downs of England, where the

COURTESY OF THE MISSOURI AGRICULTURAL EXPERIMENT STATION

FIG. 92. A GOOD TYPE OF PUREBRED RAM FOR THE FARM

The ewe lamb shown in figure 94 is the result of crossing this Shropshire ram on the western ewe shown in figure 93

Down breeds, or those having medium wool, originated, are chalk hills of low lying, rolling character. The Cheviot breed originated in the Cheviot Hills in the border country of southern Scotland and northern England and is well adapted to hilly sections. The large, long-wool breeds are best adapted to the more level farms, and the smaller breeds do best on the rougher lands. In fact, the breeds of sheep can be classified according to altitudes, with the exception of the Merino, which has shown great ability in adapting itself to a wide range of conditions.

Sheep on the livestock markets are divided into two main classes — westerns and natives. The bulk of the sheep in the United States are kept in the western range country; hence the sheep from this territory are called *westerns*. Merino blood is present to a greater or less extent in most of these sheep. However the increasing use of mutton rams in this western country during the past few years has made some change in this type of sheep. The sheep produced on the farms of the Middle West and the eastern parts of the United States are called *natives*.

COURTESY OF THE MISSOURI AGRICULTURAL EXPERIMENT STATION

FIG. 93. A WESTERN EWE

Ewes of this type are very successful as foundation material for the farm flock if they are crossed with a good mutton ram

The western ewe and her relation to the farm flock industry is of importance. These ewes are generally healthy, coming as they do from a region of vast open ranges. They are excellent foundation stock on which to cross a mutton ram of good individuality. The Merino blood in their make-up is very valuable in the ewe flock as it imparts constitutional vigor, longevity, or a long period of usefulness, and shearing qualities. Even after many generations and crosses the influence of this blood will be apparent in the flock. With the scarcity of sheep in

this section of the country, New York farmers should avail themselves of the crowded conditions of the western ranges and transfer more of these sheep to their farms. Oftentimes western ewes that are too old to stand the hardships of the range will last two or more years under the more favorable farm conditions. Some shepherding ability is necessary, however, in order to get the best results with these old ewes. Under normal conditions these ewes could be bought at a very reasonable price.

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FIG. 94. A CROSSBRED LAMB

Such lambs possess to a considerable extent the constitution of their mothers and the better mutton qualities of the sire

The western ewe does not have many twins, as twinning on the range is discouraged; however after a few crosses with mutton rams this quality will be developed.

AGE OF SHEEP TO BUY

Beginners will find it easier if they start with mature ewes rather than with yearlings, for the older ewes will have less trouble at lambing time and will give birth to more twins. On the other hand yearling or two-

year-old ewes have a longer period of usefulness before them and their vitality is greater.

GRADES OR PUREBREDS

Most farmers will do well to start with a flock of grade ewes that show good individuality. A grade ewe shows a preponderance of the characteristics of some one breed. A ewe may be of such high grade that she is as valuable as a registered sheep for practical purposes. A scrub,

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FIG. 95. A MEDIUM-PRICED PUREBRED SOUTHDOWN RAM

The short neck and the blocky conformation are points to be noted. The influence of this ram when crossed on grade or scrub ewes will be more than fifty per cent

on the other hand, does not give evidence of having a preponderance of the blood of any one breed, but has an ancestry so varied that there can be no certainty about the character of the offspring.

Only a relatively small number of men are fitted by nature and inclination for the work of successfully breeding and producing pedigreed sheep. There is a wide field for those that are fitted for this branch of the industry. The demand for purebred rams to head farm flocks is very large and bids fair to continue. The breeder of purebred livestock

is a molder of animal form in its truest sense; and unless he has his ideal of a sheep in mind at all times, he will not make great progress.

On the majority of farms the production of market lambs will constitute the safest and most satisfactory form of flock husbandry. The grade ewes should always be crossed with a purebred ram of good individuality, preferably of the breed that predominates in the ancestry of the ewes. Grading up can be accomplished very rapidly by means of a superior prepotent ram and the saving of ewe lambs. Under most conditions it is best not to cross breeds. A ram that will remedy the defects in the ewes and of the same breed should be chosen. There is wide

COURTESY OF THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

FIG. 96. SCRUB EWES
The ancestry of these ewes is very mixed

chance for selection within a breed. Extremes should always be avoided. It is the proper blending and nicking of the various qualities of rams and ewes that will give best results.

SELECTION OF THE RAM

There is an old saying to the effect that the ram is half the flock. This is as true to-day as it ever was, but its significance is greater. As land and labor become more expensive and feedstuffs continue to rise in price, efficiency and maximum results in livestock operations become a matter of greater concern, in fact an economic necessity. The purebred ram is more than half the flock because his ancestry is uniform for many generations back, and he will have a greater influence than the grade ewes upon

which he is crossed in determining the character of the lambs. A flock of lambs out of grade or scrub ewes, and sired by a prepotent purebred sire, will always resemble the ram more than the ewes, unless the ewes happen to be very high-bred grades. Commercially a flock of sheep consists of ewes and rams in the proportion of forty or more ewes to one ram; therefore it is obvious that one ram has more influence on the lambs than have the forty grade ewes. In these facts lie the logic of improving the flock thru the sire.

The benefits derived from the use of a purebred ram on a flock of grade ewes are as follows: The lambs produced will be more uniform in

COURTESY OF THE KENTUCKY AGRICULTURAL EXPERIMENT STATION

FIG. 97. GOOD MARKET LAMBS

These lambs were produced by crossing the Southdown ram shown in figure 95 on the scrub ewes shown in figure 96. Such lambs show that the ram is more than half the flock

conformation, quality, markings, and weight. A load of such lambs will always sell for more a pound than a load of miscellaneous lambs. The flock may be gradually improved by selecting a ram that is strong where the ewes are weak and by saving the good ewe lambs to replace old ewes that are discarded.

The scrub ram is a luxury that few farmers can afford. The first cost of a scrub ram is only a very small part of the entire cost. The owner of a such a ram is continually paying for him as long as he is in use in the flock. The scrub sire may cost a flock owner seventy-five dollars a year, for the lambs sired by a purebred ram of good individuality will often sell for at least one dollar more per head than the lambs sired by an inferior ram. One way to determine the yearly cost of the scrub ram

is to multiply the number of lambs sired by the difference in value of the two classes of lambs.

The scrub purebred ram also has a deleterious effect upon the sheep business. Many animals of inferior individuality possess recorded pedigrees. This is the type that should go to the block. Every animal has a pedigree of some kind, and the records are of no value unless they stand back of an animal with merit. It does not pay to buy type in a ram at the expense of heart girth and constitution. Caution should also be exercised in buying animals that have been shown at prominent fairs. Fitting for show is often a detriment to an animal that is kept for breeding purposes. If possible, rams should be bought in field condition. It is a good plan to visit a farm where stock is for sale and see how the animals in the back pasture look. The fact that a full brother of a ram is a show ring prize winner is an indication that merit exists in the family and will not in any way interfere with the utility value of the ram under consideration.

In the selection of the ram to head the farm flock, the following fundamentals should be considered. He must be purebred, and he should be active, vigorous, and masculine. The latter quality is indicated by a strong head and neck, a broad nose, a strong jaw, wide-open nostrils, and a bold alert carriage. He should be symmetrical, evenly developed, and covered with firm flesh. The back should be straight, strong, with a thick loin. He should have a dense coat of wool. Well-sprung ribs with a capacious chest and prominent brisket are desirable and indicative of the right sort of ram. Quality must not be overlooked in eagerness to obtain masculinity. The ram is looked to in many cases, especially where very ordinary ewes are used, to supply the proper mutton conformation in the market lambs. Quality and lack of coarseness are essential in the market lamb.

TIME TO BUY

Late summer or early fall is the best time to buy ewes that are to serve as foundation material for the farm flock. By so doing the ewes can be established on the farm and sized up to some extent, and a decision can be made as to the best type of ram to use on them. If the farmer is inexperienced in handling sheep, he will have opportunity to get some experience in flock husbandry before lambing time. By constant contact with the members of the flock, their needs will soon be learned.

GENERAL SUGGESTIONS ON MANAGEMENT

Well-cared-for sheep are generally free from fatal diseases. Prevention is more important and practical than attempts to cure the evil effects

of poor management. Treatment for the ailments that affect sheep is very unsatisfactory. They lack the spirit of fight and resistance, and many of their ailments are so located as to make treatment difficult. For instance, in the case of stomach worms in the fourth stomach, remedies become so diluted with digestive fluids before reaching the seat of the trouble that they are ineffective. Oftentimes this affliction only causes a general lack of thrift in the flock, which is more serious and expensive than a few fatalities.

Flock health and management are so closely related that they cannot be separated. If best results are to be attained, sheep must be treated as more than scavengers. No other livestock will respond more readily to feed and care. If sheep are fed so that bodily vigor is kept up, and if they are provided with fresh pasture at intervals, little trouble will be experienced in keeping the flock healthy. If there have been no sheep on the farm for some years, and if precautionary measures are taken, there is no reason why the flock cannot be kept healthy and thrifty indefinitely.

If possible the ewes should be turned on luxuriant pasture about three weeks before the breeding season in order that they may be gaining in condition and vigor at breeding time. This practice will insure a shorter lambing season and more vigorous lambs, and it is believed to encourage twinning.

The ram should not be allowed to become run down. He should be fed a pound of grain a day thruout the breeding season.

The ewe flock should be fed regularly and consistently to insure a wool clip of quality and good weight.

The little things and the attention to details are what count in flock management. Constant study of the business and of the needs of the individual members of the flock is of utmost importance and is characteristic of the successful flockmaster.

THE CORNELL READING COURSE FOR THE FARM

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A. R. MANN, DIRECTOR OF EXTENSION SERVICE

LESSON 134 LIVESTOCK SERIES MARCH, 1918

STARTING A FLOCK OF SHEEP

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(*Detach, sign, and return for the next lesson in this series.*)

(In answering questions, attach additional paper if needed and number the answers.)

1. Why should the beginner start with a small flock of sheep? How large should the flock be?

2. What are the two sources of income from sheep? Which is the more important?

3. What qualities should a farm ewe possess? Discuss the importance of each.

4. What are the characteristics of a healthy sheep?

5. What two essentials of soundness should a ewe possess to justify her retention in a farm flock?

6. In what order, with respect to age, are the temporary incisors of a sheep replaced by permanent teeth?

7. What type of sheep would be best adapted to your farm conditions? Give reasons for your choice.

8. How important do you consider the use of a superior ram? Why?

9. What are the characteristics of a ram suitable to head the flock?

10. What relationship exists between flock health and management? Give examples.

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ALBERT R. MANN, DIRECTOR OF EXTENSION SERVICE
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EDITOR FOR THE COLLEGE, BRISTOW ADAMS; ASSISTANT, RUTH VAN DEMAN

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PRINCIPLES OF JELLY MAKING

N. E. Goldthwaite
(University of Illinois)

The process of jelly making appears to be simple enough, merely a matter of cooking fruit juice and sugar together till the whole mass " jells " on cooling. However, as ordinarily practiced, this process may be attended by uncertain results, because so little is generally known concerning the *why* of jelly making.

In the hope of learning more concerning the *why* of the process, and in the hope also of determining as exactly as possible the conditions necessary for the making of fruit jellies, and hence of being able to lay down rules that would always work, the Department of Household Science of the University of Illinois began, in the fall of 1908, a series of systematic experiments in jelly making. By courtesy of that Department the New York State College of Agriculture is now reprinting the bulletin in which these experiments were summarized, for circulation in New York State.

As results of these experiments, it has been shown, first, that in the making of fruit jellies there are several factors to be considered; second, that it is the understanding or misunderstanding of these which leads to success or failure; and third, that whereas, on account of the variableness of fruit juices, no hard and fast rules can be laid down for jelly making as practiced in the home, yet these experiments have developed some principles, which if intelligently grasped and applied, should lead to the making of ideal fruit jellies.

DESCRIPTION OF FRUIT JELLY

Before going further, a description of the substance aimed for, that elusive substance, a good fruit jelly, should be given. Ideal fruit jelly

is a beautifully colored, transparent, palatable product obtained by so treating fruit juice that the resulting mass will quiver, not flow, when removed from its mold; a product with texture so tender that it cuts easily with a spoon, and yet so firm that the angles thus produced retain their shape; a clear product that is neither sirupy, gummy, sticky, nor tough; neither is it brittle and yet it will break, and does this with a distinct, beautiful cleavage which leaves sparkling characteristic faces. This is that delicious, appetizing substance, a good fruit jelly.

CONSTITUENTS OF FRUIT JUICE

Fruit juice consists largely of water in which are dissolved small amounts of flavoring materials, sugar, vegetable acids, and a substance called pectin. Now the vegetable acids, as we shall see further on, take part in the process of jelly making, but it is the last body, pectin, which is the essential jelly-making substance. If pectin be present in a fruit juice, it is possible to make jelly from that juice; otherwise it is impossible. Whether or not pectin is present in a juice, any one can readily ascertain by adding to a given volume of the juice (say one or two tablespoonfuls in a glass) an equal volume of ethyl alcohol (90 per cent to 95 per cent), mixing thoroly, and cooling; if pectin is present a gelatinous mass will appear in the liquid which may be gathered up on a spoon. The housekeeper, using this test, will soon discover that, apparently, different juices contain different proportions of pectin; hence, this is probably one reason for the wide difference in different fruits for making jellies. Curiously enough, this pectin frequently is not found in the juices of raw fruits, or, if found, it is likely to be in small quantity; for example, in our experiments, we found little pectin in the juice of raw apples, of raw grapes, and none at all in that of raw quince; yet the juices extracted from these fruits by cooking were full of the substance. In this connection, it should be explained that the raw juices of other fruits, such as currants and blackberries, often do contain considerable pectin; yet juices obtained by cooking the fruits are apparently far richer in this fundamental jelly-making material. Furthermore, even tho the juices of raw fruits may contain a fair amount of pectin, yet in general the jelly therefrom is often less clear than that from corresponding juices which have been cooked out of the fruits.

EXTRACTION OF JUICES FROM FRUITS

The best and also the most economical method for extracting juice from fruit has been already indicated, that is, cooking it out.

VERY JUICY FRUITS

If a very juicy fruit, such as currants or raspberries, is being used, place the clean fruit (washed if necessary) in an enamel preserving kettle, add just enough water to prevent burning (perhaps 1 cup to 4 or 5 quarts of fruit), cover the kettle and place it where the fruit will cook rather slowly, stirring it occasionally with a wooden or silver spoon. When the simmering point is reached, crush the fruit further with a well-soaked wooden masher; then continue heating it until the whole mass is cooked thru. Transfer the hot mass to a sufficiently large piece of cheesecloth (double if desired) wrung out of hot water, tie the opposite corners together, and let the juice drain into an earthenware or enamel receptacle. This juice is Extraction I. When Extraction I is fairly well drained out, usually within half an hour, do not squeeze the pulp for a second quality of jelly as usually directed, but instead make another juice extraction. To do this, untie the cheesecloth, transfer the pulp to the preserving kettle, cover it with water, stir it until it is thoroly mixed. Then cover it, bring it slowly to the boil as before, and drain it again. Extraction II is the result. The alcohol test will indicate whether much or little pectin has been obtained. If much, repeat the process for Extraction III. Some fruits will show an appreciable proportion of pectin even up to the fifth extraction, but usually a third extraction sufficiently exhausts the pectin from the fruit.

LESS JUICY FRUITS

If instead of such very juicy fruits as those considered, the juice is to be extracted from less juicy fruits, such as apples, quinces, and the like, wash the fruit, discard any unsound portions, cut it into small pieces (skins and seeds included), cover it with water, and proceed just as in the case of very juicy fruits. Relying on the alcohol test for pectin, make as many extractions from the pulp as seem profitable.

In making jelly from these extractions the writer generally prefers to handle Extraction I by itself, since this is the more normal form of the various extractions. But time will be saved if Extractions II and III are mixed together.

THE JELLY TEST

Altho each housekeeper doubtless has her own satisfactory jelly test; yet for reasons given below it may be well to describe the one that has given best results in our work. Our jelly test is one probably used by many, and is that point at which the boiling mass "jells," sheets off, or breaks off, as a portion of it is allowed to drop from the stirring spoon. This is a quick test, and hence much better than the time-honored one of

taking out a portion of the hot jelly, and allowing it to cool to see if it "jells," for while this cooling process is going on outside the saucepan the jelly is continuing to cook inside the saucepan. Time is too precious at this point to wait for any cooling of samples. When the jelly is just right to be taken off the fire, no time should be lost in removing it.

THE PROPORTION OF SUGAR TO JUICE

EXTRACTION I

In making jelly from these various extractions, let us first consider Extraction I. Assuming that this juice has been obtained from a naturally good jelly-making fruit, that is, one rich in pectin and also acidic (sour), such as currants, sour apples, and unripe grapes, then the process of making jelly is comparatively simple. Under such conditions success or failure depends almost entirely on the proportion of sugar used. The correct proportion of sugar to the pectin of the juice in hand means success, while an underproportion means a tough jelly, and an overproportion means more or less of a failure, depending on how great that overproportion is. Probably more good jelly-making material is spoiled thru the use of an overproportion of sugar than from all other causes combined; and this is true because the would-be jelly maker blindly follows the old rule of a measure of sugar to a measure of juice.

This exceedingly important point, then, the correct proportion of sugar to juice, needs to be very thoroly understood. In studying it, first let us consider the result of trying to make jelly from fruit juice alone, that is, without sugar. If a certain volume (say 1 cup, 1 pint, 1 quart) of good jelly-making fruit juice is boiled down until a jelly test is obtained, we find on cooling the very small product that it is jelly-like, but it is not an ideal jelly. It is a tough, opaque, unpalatable mass consisting of the pectin, more or less impure, which was contained in the original volume of juice.

Second, let us consider the results of boiling such a given volume of juice with varying proportions of sugar. If this volume of juice is boiled with, say, ¼ its volume of sugar until the jelly test is obtained, we find, on cooling, a larger product than the preceding — one more like jelly, one less opaque,. tho still tough. Continuing this process and taking successive volumes of juice equal to that taken first, and boiling each successively with an increasing proportion of sugar (½, ⅔, ¾, 1, 1¼ of the volume), what are the final results? Examination of them shows that with an increasing proportion of sugar each successive product increases in volume, the depth of color diminishes, and each is more tender, more transparent, more palatable than its predecessor, until one is reached

that approximates a perfect jelly. Beyond this, with increasing proportion of sugar, the product continues to increase in volume, the color to decrease in intensity, but the texture to become softer and softer until finally the pectin appears in lumps in the mass, or a mere sirup results.

The results of such tests are graphically shown in figure 1. The juice contained in glass *a* shows the volume used in making each of the jellies *b*, *c*, *d*, *e*, *f*, the proportions of sugar to juice being respectively $\frac{1}{2}$:1, $\frac{3}{4}$:1,

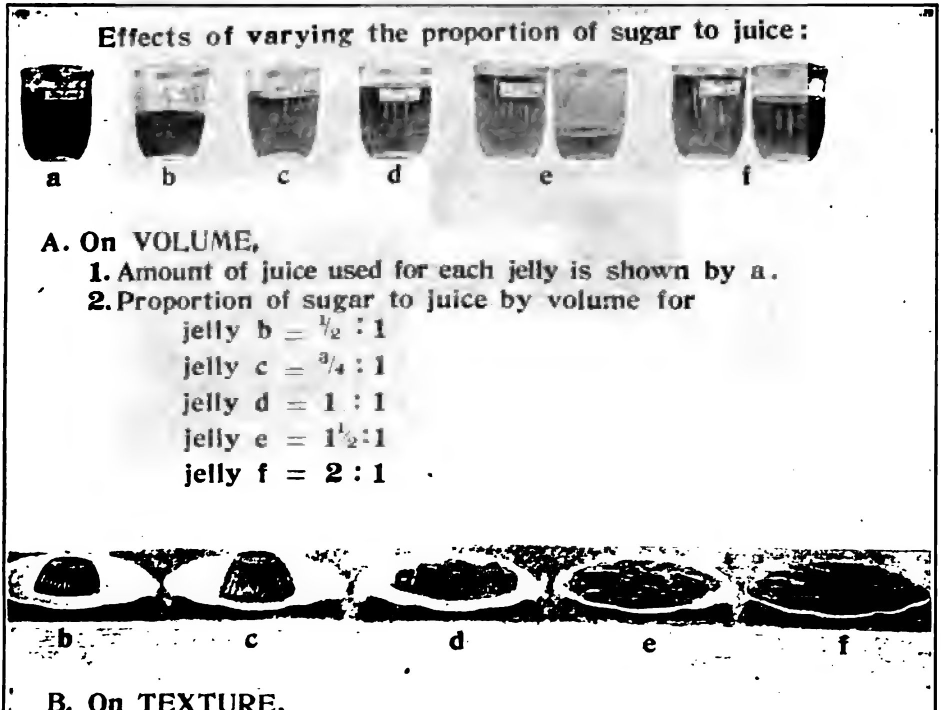

FIG. 1. EFFECT OF THE PROPORTION OF SUGAR ON THE VOLUME AND THE TEXTURE OF JELLY

1:1, $1\frac{1}{2}$:1, 2:1.[1] Note the effect of this increasing proportion of sugar per volume of juice on the volume of jelly produced. Note, also, the effect on the texture as shown when the jellies were transferred to plates. Jelly *b* was very tough and unpleasantly sour; jelly *c* was tender but would "stand alone"; jelly *d* was too tender to "stand," but in both

[1]It is probably unnecessary to explain that the expression $\frac{3}{4}$:1 means three-fourths of a volume of sugar to one volume of juice, while the expression 1:1 means one whole volume of sugar to one of juice. Bearing this explanation in mind, the expressions $\frac{1}{2}$:1, $\frac{1}{4}$:1, and the like, are readily understood.

taste and texture was suitable for jelly cake; jellies *e* and *f* were quite impossible — they were made to show the effect of a large over-proportion of sugar. Jellies corresponding to *c*, *d*, and *f* are more clearly shown in figure 2. Jelly *c* in texture, color, and taste, was ideal for table use.

What is the important lesson of such a succession of products? It is simply this: that the given volume of juice used for each jelly sample contains a certain quantity of pectin in solution, and that this quantity of pectin is capable of utilizing profitably a definite proportion of sugar only. Up to this definite proportion of sugar to pectin, the jelly produced from the given volume of juice is decreasingly tough and increasingly

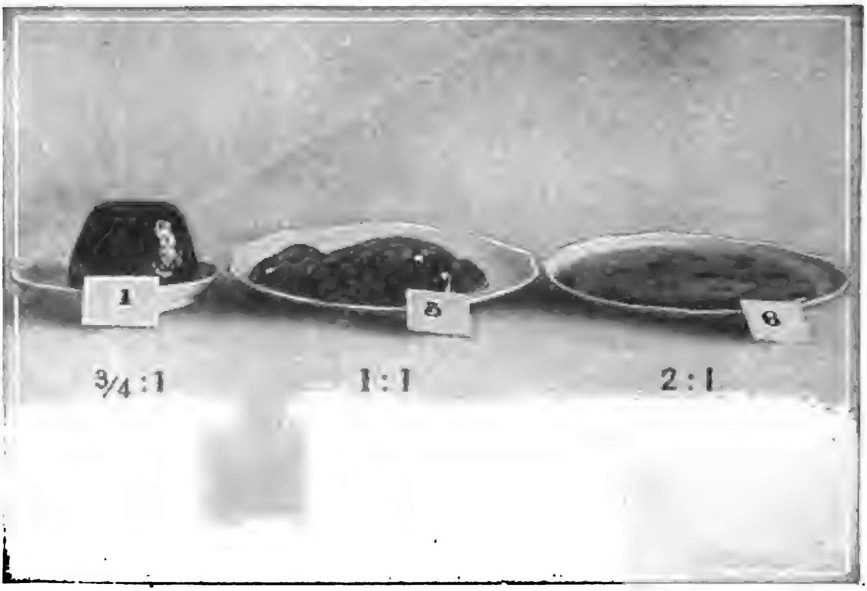

FIG. 2. SAMPLES OF APPLE JELLY SHOWING EFFECTS OF DIFFERENT PROPORTIONS OF SUGAR TO JUICE

tender, until finally a jelly of ideal texture and appearance is formed. Beyond that definite proportion of sugar to pectin, the jelly produced is increasingly soft until finally it fails to hold together at all, that is, it fails to " jell." The error is self-evident: too much sugar for the pectin present in the juice has been used. No amount of mere cooking after this will rectify the error; continued cooking will produce a gummy mass. Adding more sugar and cooking will but make the jelly more sirupy. The remedy is to add more pectin, that is, to boil the product with more juice, perhaps even with as much as was used in the first place; but the amount of juice added must depend of course on how great the over-

proportion of sugar has been, since this addition of juice is for the purpose of supplying sufficient pectin to take care of the surplus of sugar. Needless to say this made-over jelly, tho it may come out fairly well, will not equal in quality an otherwise corresponding jelly made originally with the proper proportion of sugar to juice.

For most juices of such fruits as those already indicated, that is, those that are rich in pectin and are fairly acidic, it is found that for Extraction I, the correct proportion of sugar to juice by volume usually varies from ¾:1 to 1:1. Currants and partially ripened grapes yield a juice so well adapted to jelly making that they usually demand the proportion 1:1, while ¾:1 is likely to be the correct proportion for red raspberries, blackberries, and also for juices from fruits to which much water must be added even to make the first juice extraction, such as sour apples, crab apples, cranberries, and the like. But in any case the jelly maker must be wary when proportioning sugar to juice. Doubtless much depends on the condition of the fruit itself; if the juice seems unusually watery, as currants just after a rain, and the alcohol test does not indicate pectin in plenty, then lessen the proportion of sugar. It is better to err on the side of too little rather than too much sugar if a jelly that will "stand alone" is desired; if a softer and sweeter jelly is desired, then of course a larger proportion of sugar should be used.

EXTRACTIONS II AND III

Let us now turn our attention to a consideration of Extractions II, III, and so on. Tho it is well worth while to work up these extractions into jelly, yet great care must be exercised in doing so. From what has gone before, it is evident that since much water has been used in their preparation, and since each is correspondingly less acidic and less rich in pectin than its predecessor, this mixture will utilize a much less proportion of sugar than will Extraction I. However, if these facts are kept in mind and the sugar carefully proportioned to the pectin that is present, an excellent quality of jelly can be made from these dilute juices.

A good method for proportioning sugar to juice in dealing with these dilute extractions is to concentrate (boil down) the mixture rapidly till the resulting juice approximates the richness of Extraction I, which may be judged by the alcohol test, by the appearance, and by the taste, then to measure the resulting juice and add the proportion of sugar already used for Extraction I. If these extractions are treated otherwise, the jelly maker may be merely proportioning sugar to water, since, as already emphasized, these later extractions are so largely made up of water.

However, if the jelly maker wishes to treat these extractions on the same general plan as Extraction I, let her make a trial sample of jelly

from their mixture, proportioning the sugar, $\frac{1}{8}$:1 or at most $\frac{1}{4}$:1, then, according to the quality of the jelly produced, let the proportion of sugar be increased or decreased in working up the remainder of the dilute juice.

The jelly from these dilute extractions will be quite as clear and the texture quite as good as that made from Extraction I. In other words, there is absolutely no need of the second quality of jelly which some housekeepers have had a fashion of making from the juice "squeezed out" of a drained fruit-pulp. If the fruit is properly handled, all the jelly therefrom will be of first quality. The practice of making fruit butter from the pulp remaining after juice Extraction I, is a good one. In this case, of course, there would be no juice Extractions II and III.

Interesting however, in this connection, from an economic standpoint, are the results obtained by two experienced housekeepers in working up nearly like quantities of partly ripened grapes. Housekeeper I had more than half of the five quarts of stemmed grapes that the two had gathered in common; from her portion she made something over two glasses of jelly and five glasses of butter. Housekeeper II, on the other hand, from her portion of the fruit, by preparing two juice extractions, made seven glasses of an excellent quality of jelly. The writer's experience indicates that the grape pulp which Housekeeper II had left, would have yielded at least one more extraction of juice, containing a paying quantity of pectin.

After the winter's supply of grape juice has been extracted, which is best done by cooking the fruit covered with water in a double boiler, further juice extractions should be made from the pulp, as already described, and used for jelly. This is a good plan, since jelly made from these later extractions rarely shows the cream-of-tartar crystals so likely to appear in grape jelly that has stood for a length of time.

TIME NECESSARY FOR JELLY-MAKING PROCESS

In discussing the proportion of sugar to juice, nothing has been said to indicate the time necessary for the jelly-making process. As a matter of fact this time varies with several factors: with the proportion of sugar to juice, the time decreasing as the proportion of sugar is increased; with the proportion of pectin in the juice, a thin juice demanding more time for concentration; and possibly to some extent also with the proportion of acid in the juice. Of course there is an interdependence among these factors that may either lessen or lengthen the necessary time of boiling in the case of any particular juice. In currant juice, for example, these factors are so nicely adjusted that 8 to 10 minutes is sufficient time for making jelly from Extraction I; while the corresponding juice from raspberries, blackberries, and apples, may demand from 20 to 30 minutes.

But in any case, any jelly, when the process is once begun, should be made as quickly as possible; no simmering for hours should be allowed, since long action of the acid in the juice transforms the pectin into substances that have no jelly-making power. An example of this sort came to the writer's attention thru the failure of one jelly maker to make her grape jelly "jell." Hours of simmering on the back of the stove had destroyed the pectin, also too much sugar had been used, and between the two errors, a dark, gummy, unpalatable mass had resulted.

TIME NECESSARY FOR BOILING SUGAR WITH JUICE

Directly connected with the total time necessary for the jelly-making process, is the question, When should the sugar be added to the juice. Should it be at the beginning of the process, according to the old method? or (hot) near the end of the process, according to the newer method? or (hot) midway between these extremes? Let us designate these three methods respectively as long-boiling, short-boiling, and mean-boiling.

Very elaborate and careful experiments, the details of which need not be described here, have been made in this laboratory in order to answer these questions. The results, so far as they yet indicate a choice in these methods, show that the mean-boiling method is probably the best, all things considered. The chemist knows that the longer sugar is boiled with a weak acid, as fruit juice suitable for jelly making is, the more this sugar is inverted (split) into two simpler sugars, each less sweet than the original sugar. Tho this loss of sweetening power may be disregarded, yet the extent of the inversion which has taken place does affect the texture of the jelly; that is, if little inversion has occurred (short-boiling method), the original sugar used is likely to crystallize out; if much inversion has occurred (long-boiling method), one of the simpler sugars formed may appear in crystalline masses. However, it should be said that neither of the crystallizations is likely to occur if the sugar has been originally properly proportioned to the pectin in the juice and if the resulting jelly has been properly sealed up. Illustrative of this statement is the fact that from seven different fruits a series of three jellies each, long-, short-, and mean-boiling, were carefully made and sealed four years ago; as yet no one of them shows any sign of crystals. Repeated experiments however show that an overproportion of sugar to juice is fairly certain to lead shortly to a crystallization of sugar from the jelly. Apparently a jelly properly made and properly sealed will keep almost indefinitely.

Perhaps it should be explained that the object of adding the sugar

hot, heated thru, not scorched, is that the total cooking process may not be prolonged by a partial cooling as is the case if the sugar is added cold to the hot juice. In any case the mass should be carefully stirred fairly constantly after the sugar is added, in order to prevent burning.

Experiments prove further that it is economy not to make jelly by the long-boiling method, inasmuch as so much sugar is lost thereby in the skimmings. The more thoroly the juice is clarified by skimming before the addition of the sugar, the better from an economical standpoint.

ACIDITY OF THE FRUIT JUICE

The absolute necessity of the presence of pectin in juices to be used for fruit jellies has been made as emphatic as possible. Simultaneously, attention has been repeatedly drawn to the fact that good jelly-making juices are also acidic. The juices that are ideal for jellies are both rich in pectin and are fairly acid, such as currant, partly ripened grape, and crab apple. However, many fruit juices contain the first requisite, pectin, in greater or less quantity, but are deficient in acid; quince, pear, peach, and sweet apples are examples of this. With these juices, if we choose to do so, we can help nature out by adding a little acid of vegetable origin (tartaric or citric) to the juice. It is difficult to state the exact amount to be added, since juices vary much in acidity even in the same kind of fruit. A fair rule, however, is to add enough of the tartaric or the citric acid powder to make the juice about as acid to taste as good tart apples; but before deciding about the taste, care must be taken to see that the powdered acid is entirely dissolved and the juice well stirred. By way of suggestion, add one level teaspoonful of the powdered acid to a quart of juice, and if examination, as indicated, shows this amount of acid to be insufficient, increase the amount by small additions until the juice seems satisfactory. Great care, however, must be exercised in any addition of acid even tho it may be the same as that already in the fruit, since such addition invariably affects the flavor of a delicate fruit. By this method, however, it is possible to make jelly from any pectin-bearing fruit juice. Peach and pear jellies may be so made, but the fine flavor of the fruit is invariably impaired. Thus also the texture of strawberry jelly is improved by a slight addition of acid, but the same cannot be said of its flavor. But sweet apple and quince, both of which are rich in pectin — the latter phenomenally so — yield jellies improved not only in texture, but also in taste by an addition of acid to the juice.

Doubtless it is unnecessary to warn the housewife that if juice Extractions II, III, and so on, are to be acidified, they should be concentrated before adding the acid in order to prevent an excess of it.

In general, with the exception of sweet apple or quince, it seems better for the inexperienced jelly maker to learn to manipulate successfully the ideally good jelly-making fruit juices, such as currant, sour apple, crab apple, raspberry, blackberry, and partly ripened grape, before she attempts to make jellies of juices not well adapted by nature for jelly making, as peach, pear, strawberry, and cherry. In regard to strawberry and cherry jellies, it may be stated here that it has been found possible to make fair samples of these without the addition of acid if an overproportion of sugar is avoided, and if the boiling is carried somewhat beyond the point at which the jelly test is first observed; however this must be done with great care lest a gummy mass finally result.

A method of making jellies which has something to commend it is to take sour-apple juice as a basis for the jellies, and to use sufficient other fruit juice to supply flavor. This method has apparently been used by manufacturers, but it may be used by the housewife advantageously in some cases. By means of the sour-apple juice both pectin and acid are supplied to a fruit juice which may be deficient in one or both these essentials for jelly making, and a very palatable form of food be the result.

QUANTITIES OF JUICE USED

The question has frequently been asked, How much juice can I make into jelly at one time. Simultaneously with the question several housekeepers have stated that they never attempt more than one glass, or two at most. The writer has found no difficulty under household conditions in handling juice sufficient for from four to six glasses or even more at one time. But to do this, everything must be ready for the completed process before the juice is put on to boil — a pan with the glasses, boiling water for sterilizing them, and the dry measured sugar already hot. On boiling, the juice must be rapidly and thoroly skimmed, the hot sugar added at the proper time, more skimming; then the instant the jelly test is observed, the glasses must be sterilized with the boiling water, and the hot jelly poured into them till each is completely full. With some jellies there is danger of the mass jellying in the kettle before it can be removed, hence the necessity for rapid action and a cool head.

In this connection it may be stated that many good housekeepers prefer to can their fruit juices in season, making up the jellies as needed. This plan has much to commend it. Often, time is precious in the fruit season and if the juice extractions are properly heated to boiling, and sealed into well-sterilized cans just the same as canned fruit, they will keep quite as well as the latter, and jelly can be made when desired.

STERILIZATION OF JELLY GLASSES

As already indicated, jelly glasses should be well sterilized just before using. To effect this, proceed as follows: Place the glasses in a tin pan, fill each with boiling water, let them stand until needed, empty and allow them to remain inverted until needed for use; then fill them with hot jelly as already described.

SEALING UP JELLIES

If jellies are to stand any length of time before using, they should be properly sealed from the air. After the glasses have been filled completely with the hot jellies, they should be set in a cool place for the contents to harden. Jellies slightly undercooked may be covered with panes of glass and allowed to harden in the sun. In either case, when the jellies are well set, the glasses should be filled with hot paraffin — the jelly will have shrunken, leaving space for this — not merely melted paraffin, but hot paraffin so that all germs that may have fallen on the surface of the jelly may be killed and future trouble with them obviated. Close the glasses with hot, clean tin covers, and keep in a dry, cool place.

A JELLY FAILURE

A very interesting and instructive jelly failure was brought to the writer's attention; this failure was a thin jelly full of transparent, cubical crystals. Examination proved these to be uninverted sugar, that is, the original sugar used. Further examination showed that the original juice had been but slightly acidic, and also that it was not rich in pectin. Questioning the maker disclosed the fact that the sugar had been added near the end of the jelly-making process (short-boiling). Now, at least three errors were evident: (1) an overproportion of sugar to (2) a weakly acidic juice, and (3) one not rich in pectin. Consequently the jelly had never "jelled"; a mere sirup had resulted, from which the uninverted sugar had subsequently crystallized out. The total result was much the same as tho a thick sirup from sugar had been merely colored and flavored by fruit juice and allowed to stand until crystallization of the sugar had occurred.

GENUINE ORANGE AND LEMON JELLIES

The writer had frequently noticed that well-made orange marmalade always showed a jelly-like appearance, denoting that there must be pectin in the fruit. The alcohol test applied to the squeezed out raw juice showed its entire absence. Subsequent experiments finally located the

pectin in the white inner skin of the fruit. Similar examinations of the lemon showed the presence of pectin in the white inner skin, but none in the raw juice. After many experiments it was found that excellent, genuine orange or lemon jellies could be made by careful extraction of this pectin, adding sufficient natural juice of the fruit for flavoring and acidity, then proceeding to make jelly as with any fruit. The process is approximately as follows: The yellow outer skin of the fruit is carefully and entirely peeled off, the white inner skin is removed from the juicy portion. This white inner skin is passed thru a fine meat-grinder, soaked, in sufficient water to cover, from two to twenty-four hours, then cooked slowly for some hours and drained. This Extraction I is particularly rich in pectin. Subsequent extractions all show pectin, but continually decreasing in amount. These extractions may be concentrated and mixed with the first extraction if desired. To the whole, sufficient natural juice is added to give a pronounced flavor, and it is then made into jelly the same as any other juice, due care being taken not to use an excess of sugar. If the thin yellow outer skin of the fruit has been carefully removed, there will be little if any bitter taste to these jellies.

If desired, the white inner skin of oranges and lemons may be used as a source of pectin to add to other fruits that are more or less deficient in this important substance. For example, some excellent rhubarb jelly was made in the kitchen of this Department by adding to the cooked-out rhubarb juice a rich pectin extraction obtained from lemons as indicated.

For such purposes in general, it is suggested that the white inner skins of oranges and lemons be saved from time to time, cut into fine pieces and dried, then later soaked up and used as desired. Hence, what is usually a waste product, but what has been found to be an abundant source of pectin, may be used by the thrifty housewife in numberless ways to help out in her jelly making.

It may be worth while to note in this connection that the thicker skinned the oranges are, the greater is the yield of pectin that can be obtained from them.

The white inner skin of grapefruit is also rich in pectin, but the persistent bitter taste interferes with its use in jellies. However, the housekeeper may find it valuable in marmalades.

BLUEBERRY JELLY

Mention should be made of blueberry jelly — certainly not a common jelly so far as the writer knows. Examination of this fruit shows a pulp exceedingly rich in pectin, one which will stand several extractions. Altho the juice is fairly sweet to taste, yet it is sufficiently acidic to yield jelly

of excellent texture even when the proportion of sugar to juice (Extraction I) is 1:1. With this proportion of sugar, the total time of making the jelly need not exceed 10 minutes.

The blueberry as a jelly fruit seems quite equal to the currant, with this difference in the jellies. Altho each is delicious, currant jelly is tart to the taste, while blueberry jelly is sweet; hence they may be used for different purposes in the menu.

BEET SUGAR VERSUS ORDINARY CANE SUGAR

A question concerning the relative merits of beet sugar and cane sugar in jelly making has occasionally been asked. Our experiments show that when the two sugars are equally pure, there is no difference in texture, taste, or appearance of jellies made therefrom. The only difference observed was that the volume of jelly produced from a given amount of juice and sugar was slightly less when beet sugar was used than when cane sugar was used. This difference being considered negligible, the two sugars may be used interchangeably.

NATURE OF PECTIN

Perhaps it may be interesting to explain that pectin, the fundamental jelly-making substance of fruit juices, the gelatinizing substance that makes these juices "jell," is apparently akin to starch chemically; it has no relationship whatever to gelatin. It, like starch, is made up of the elements carbon, hydrogen, and oxygen; while gelatin, in addition to these elements, contains nitrogen. Moreover, pectin is of vegetable origin, while gelatin is of animal origin.

SUMMARY

The principal points may be briefly summarized as follows:

1. Fruit juice to be used for jelly making must contain pectin. It must also be acidic.

2. Juices that are to be used for jelly making should be extracted by cooking them out of the fruit.

3. The most common cause of failure in jelly making is an overproportion of sugar to juice, that is, to the pectin in the juice.

4. A short, quick test in jelly making is preferable to a test which involves a waste in time.

5. There need be no second quality of jelly. All may be of first quality if the juice is properly extracted and handled.

6. Experiments, so far, indicate that the mean-boiling process in jelly making is preferable to the long-boiling or to the short-boiling process.

7. Any given juice, when once the boiling is begun, should be transformed into jelly as rapidly as possible.

8. The time necessary for the boiling of a quantity of jelly apparently varies with several factors: the proportion of sugar to juice, the proportion of pectin in the juice, and possibly, too, with the acidity of the juice.

9. The hot jellies should be poured at once into hot, sterilized glasses, and after having "set" should be carefully sealed.

10. Jellies from pectin-containing but slightly acid fruits may be made by adding a vegetable acid to the juice, but this process is not recommended except in the case of sweet apple or quince juice.

11. Cherry and strawberry jellies are possibilities if the hot mass is boiled somewhat beyond the first jelly test observed.

12. The white inner skins of oranges and of lemons are prolific sources of pectin; hence genuine jellies from these fruits may be made. The pectin from these skins may also be used for strengthening other fruit juices.

13. Apple juice may be made a basis for other fruit jellies.

14. Blueberries are recommended as an excellent fruit for jelly making.

15. Beet sugar and cane sugar may be used interchangeably in jelly making.

16. Pectin is probably akin to starch in its chemical nature. It has no relationship to gelatin.

17. Good jellies cannot be made from all juices by rule of thumb. Jelly making, as practiced in the home, is an art founded on scientific principles. It consists in so controlling results by means of sugar and acid, and by boiling, as to cause the pectin to "set" in a continuous mass thruout the volume allotted to it.

JELLY SCORE CARD

In these days of friendly rivalry at farmers' institutes, fairs, and the like, there is much demand for score cards of various sorts. The following is a jelly score card[2] suggested by the author.

	Points	Totals
I. Choice of fruit for jelly making		5
II. Color:		10
a. As determined by the fruit	4	
b. Depth, as influenced by:		
1. Sugar	3	
2. Boiling	3	
III. Clearness (transparent or otherwise)		10
IV. Absence of crystals		5
V. Texture:		30
a. Preservation of shape when removed from mold, not sirupy	5	
b. Power of quivering	5	
c. Can be cut with spoon; angles retain shape, not gummy nor sticky	5	
d. Tenderness versus toughness	5	
e. Character of cleavage:		
1. Not brittle, yet breaks with distinct cleavage	5	
2. Sparkling faces	5	
VI. Taste or palatability:		40
a. Preservation of natural flavor of fruit	25	
b. As affected by sugar, neither too much nor too little	10	
c. As affected by boiling, not burned	5	

[2] Compare Schermerhorn, Grace. Journ. Home Econ. 6: 148.

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MARCH, 1918 FOOD SERIES LESSON 115

CORNMEAL ONCE A DAY[1]

Cornmeal is a good food because it is a cheap source of energy. The nutrients are so closely bound up with the fiber, or roughage, that long cooking is required to soften the fiber and make them available.

More liquid should be used, and more fat may be used, with the very fine cornmeal made by the new milling process, than with the coarser meal made by the old process or ground at home. The home grinding of cornmeal saves the germ and certain other nutrients that are lost by the new milling process, but, on the other hand, the meal thus ground does not keep so well as the finer milled product.

CORNMEAL MUSH

1 cup cornmeal
1 teaspoon salt
3½ to 5 cups boiling water, or scalded milk, or milk and water

Slowly sift the cornmeal into the hot liquid, or mix it with sufficient cold water to give it the consistency of a pour batter and add it to the remaining hot liquid in the upper part of a double boiler. Cook the mixture over direct heat, stirring it constantly until it thickens; then cook it over hot water for about 4 hours. Or use a fireless cooker container instead of a double boiler, and as soon as the mush has thickened place it in the fireless cooker for 5 or 6 hours or overnight. One cup or less of raisins, chopped dates, or figs may be added just before the mush is served.

Left-over cornmeal mush may be poured into a pan wet with cold water. When it is cold it may be sliced, rolled in dry meal, browned in a small amount of fat, and served with sirup. Another way of using it is to

[1] Additional recipes for using cornmeal may be found in *Cornmeal as a Food and Ways of Using It*, Farmers' Bulletin 565, which may be obtained from the Editor and Chief, Division of Publications, U. S. Department of Agriculture, Washington, D. C. Recipes for cornmeal breads are given in a bulletin entitled *Wheat-Saving Breads*, which is published by the New York State Food Commission in cooperation with the Federal Food Board and may be obtained from the Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

cut it in cubes, fry them in deep fat, and serve them with sirup or tomato sauce.

If the mush is to be fried it should be made stiff by using the smaller proportion of water. For a breakfast cereal more water may be used, the amount depending on the consistency desired.

SCALLOPED CORNMEAL AND CHEESE

Into a buttered baking-dish pour thick cornmeal mush and cheese sauce in alternate layers, using about 1 cup of sauce to 2 cups of mush. Cover the top with buttered crumbs, and bake the mixture for 30 minutes in a moderate oven.

CHEESE SAUCE

3 tablespoons butter	Salt
3 tablespoons flour	Paprika
1 cup milk	1 cup cheese, grated

Melt the fat, remove the pan from the heat, add the flour, and stir the mixture until it is smooth. Add the milk, return the pan to the heat, and cook the sauce until it thickens, stirring it constantly. Place the pan over hot water, add the cheese, and allow it to melt.

INDIAN PUDDING

6 tablespoons cornmeal	½ teaspoon salt
1 cup cold water	½ teaspoon ginger
2½ cups milk	½ teaspoon cinnamon
½ cup molasses	

Heat the milk, and carefully add the cornmeal mixed with the cold water. Add the other ingredients, and bring the mixture gradually to the boiling point, stirring it frequently to prevent lumping. Cook it in a fireless cooker for 3 hours or more, or pour it into a greased baking-dish and bake it in a slow oven for 2 hours. The pudding is improved by the addition of raisins. It may be served hot or cold, with or without cream.

INDIAN RABBIT

½ cup cornmeal	2 tablespoons fat
1 teaspoon salt	¼ pound cheese
½ cup cold water	Dash of cayenne
1½ cups hot water	

Wet the cornmeal with the cold water, add it carefully to the hot water, and cook it over direct heat until it thickens, stirring it constantly. Place it over hot water, and steam it for 4 hours. Before serving it, add the cheese, grated or in small pieces, and the fat. When the cheese melts, serve the rabbit on crisp toast.

CORNMEAL POLENTA

1 cup cornmeal	1 egg
2 teaspoons salt	1 tablespoon fat
1 cup milk	½ cup grated cheese
2½ cups boiling water	Dash of cayenne

Mix the cornmeal, the salt, and the cold milk. Add this mixture carefully to the boiling water, and cook it over direct heat, stirring it constantly until it thickens. Cook it over hot water for 4 hours. Add the beaten egg, the fat, and the cheese, and pour the mixture into a shallow pan. Cool it, cut it into cubes, arrange them in a pyramid on a flat dish, and sprinkle them with paprika and grated cheese. Reheat the polenta before serving it.

SOUTHERN SPOON BREAD

2 cups scalded milk	2 tablespoons fat
1½ cups cornmeal	1 or 2 eggs
1 teaspoon salt	

Sift the meal and the salt into the scalded milk. Cook the mixture for 5 minutes in a double boiler, and add the fat. Allow it to cool. Add the yolks of the eggs, and fold in the well-beaten whites. Turn the mixture into a well-greased baking-dish, and bake it in a moderate oven for 30 minutes. Serve it hot in the baking-dish.

PEANUT SCRAPPLE

1 cup fine cornmeal	2 quarts boiling water, or milk and water
1 cup hominy grits	1 cup ground peanuts
2 teaspoons salt	

Sift the cornmeal and the grits into the boiling salted water, stirring it constantly. Cook it for at least 1 hour, stirring it occasionally. Five minutes before removing it from the fire, add the peanuts. Pack the mush in a deep pan, and store it in a cool place. When ready to use it, cut it in ½-inch slices, and brown it in a small amount of hot fat.

Grated cheese may be substituted for the peanuts. When ready to use the scrapple, cut it in cubes, roll them in grated cheese, and pile them on a greased tin. Bake them in the oven until the cheese is toasted.

CORNMEAL AND ROLLED OATS COOKIES

1 cup cornmeal	½ cup fat
1 cup rolled oats	1 teaspoon soda
1 cup molasses	1 cup buckwheat flour
1 teaspoon salt	½ teaspoon nutmeg
1 cup sour milk	¼ teaspoon ginger

Heat the cornmeal, the rolled oats, the molasses, the salt, and the milk together, stirring the mixture constantly until it becomes a thick paste. Remove it from the fire, and add the fat and sifted soda, flour, and spices. Roll the mixture thin, cut it with a small cutter, and bake the cookies in a moderately hot oven.

CORN BREAD (3 LOAVES)

1½ cups cornmeal
5 cups water
5 teaspoons salt
2 tablespoons corn sirup
1-2 cakes compressed yeast, depending on time allowed for rising
8 cups flour

Cook the cornmeal in 1 quart of water until it is soft. Add the salt and the sweetening, and cool the mush until it is lukewarm, stirring it often enough to avoid the formation of a film. Then add the yeast which has been softened in 1 cup of water. If the bread is set overnight, 1 cake of yeast and 6¼ teaspoons of salt should be used. Add the flour, and knead the dough, using as little flour on the board as possible. Let the dough rise for 3½ hours, or until it has doubled in bulk, at the approximate temperature of 75° F. Work it down and let it rise again for 1½ hours, or until it has increased in size by one-half. Mold it, place it in pans, and let it rise until it has almost doubled in bulk. Bake the loaves for 50 or 60 minutes in a moderately hot oven, or at a temperature of 360° to 400° F. Remove the bread from the pans at once and cool it quickly.

CHARLES TAYLOR

CORN AND OATS BREAD (2 LOAVES)

2 cups cornmeal
2 cups rolled oats
4 cups water or milk and water
½ to 2 cakes compressed yeast
5 teaspoons salt
5 cups wheat flour

Pour 3 cups of boiling liquid over the cornmeal and the rolled oats, and cook the mixture for 2 minutes in a double boiler. Cool it until it is lukewarm. Soften the yeast in the remaining cup of liquid. If the bread is set overnight, use from ½ to 1 yeast cake and 6¼ teaspoons of salt. When the cereal mixture is lukewarm, add the yeast and the salt, and then the wheat flour, using slightly more than 5 cups if necessary. Knead the dough. Finish making the bread according to the directions given for corn bread.

CHARLES TAYLOR

THE CORNELL READING COURSE FOR THE FARM HOME

PUBLISHED BY THE NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY, ITHACA, NEW YORK
ALBERT R. MANN, DIRECTOR OF EXTENSION SERVICE
SUPERVISORS, MARTHA VAN RENSSELAER, FLORA ROSE, AND HELEN CANON
EDITOR FOR THE COLLEGE, BRISTOW ADAMS; ASSISTANT, RUTH VAN DEMAN

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MARCH, 1918 | FOOD SERIES | LESSON 116

MAKE EVERY CRUMB COUNT

WINIFRED MOSES

Bread crumbs may be substituted for a part of the flour in making such quick breads as griddle cakes, muffins, gingerbreads, and brown breads. One and one-half cups of bread crumbs will replace one cup of flour. In a recipe calling for two cups of flour, one and one-half cups of bread crumbs may be used to replace one cup of flour. The result is a cake or a muffin that is lighter than one made entirely of flour. If the bread crumbs are very dry, it may be necessary to increase the amount of liquid. Yeast bread made with bread crumbs is excellent. Bread crumbs may take the place of flour in thickening gravy.

HOW TO PREPARE BREAD CRUMBS FOR USE

Save all the left-over breads, muffins, or bread crusts, and crumbs from the cutting board. Dry them thoroly in the oven, but do not brown them. Put the dried bread thru a meat grinder, or crush it with a rolling pin. Store the crumbs in a covered container. They are then ready for coating croquettes or covering scalloped dishes. Bread used in this way not only adds to the attractiveness of the dish by supplying a crisp outer covering, but somewhat increases the nutritive value. The crusts may be separated from the white part of the bread before grinding, if desired.

Stale bread crumbs are made from stale bread by grating the loaf or rubbing one piece against another.

Greased crumbs are prepared by melting from 2 to 3 tablespoons of fat, adding 1 cup of crumbs, removing the pan from the fire, and stirring the crumbs until all are coated with fat.

CHEESE PUDDING

1 egg, slightly beaten
2 cups milk
Salt and pepper
1½ cups soft bread crumbs, or 4 thin slices of stale bread slightly buttered
¼ to ½ cup finely shaved cheese

Combine the egg, the milk, the salt, and the pepper. Soak the crumbs or the buttered bread in this mixture. Line the bottom of a greased baking-dish with the crumbs or the soaked bread. Sprinkle the cheese on the bread, and cover the top of the dish with more crumbs or another slice of bread. Add the remaining milk. Bake the pudding in a slow oven until it thickens like custard.

BREAD-CRUMB MUFFINS

1½ cups bread crumbs
¾ cup milk
1 egg
2 tablespoons sirup or molasses
4 teaspoons baking powder
½ teaspoon salt
1 cup flour
2 tablespoons fat

Soak the bread crumbs in the milk until they are soft, and put them thru a colander. Add the beaten egg and the sweetening, then the baking powder, salt, and flour sifted together. Add the melted fat. Bake the muffins in a moderate oven for about 30 minutes.

BREAD-CRUMB GRIDDLE CAKES

2 cups sour milk
¾ cup bread crumbs
1 or 2 eggs
1 teaspoon soda
1 tablespoon molasses
¾ cup flour
Salt

Pour 1 cup of the sour milk over the bread crumbs. Let them soak for ½ hour, and put the mixture thru a colander. When the first mixture is completed, dissolve the soda in the remaining sour milk. Add the milk to the bread mixture, and stir in the sweetening, and the salt and the flour sifted together. Add the well-beaten egg, and stir the mixture thoroly. Bake the cakes on a hot greased griddle.

BREAD-CRUMB GINGERBREAD, I

1½ cups bread crumbs
1 cup flour
1 teaspoon baking powder
1 teaspoon soda
½ teaspoon salt
½ teaspoon ginger
1 cup molasses
1 cup sour milk

Soak the bread crumbs in the sour milk until they are soft. Put the mixture thru a colander. Add the molasses, and then the dry ingredients sifted together. Stir the mixture thoroly, and bake it in a moderate oven.

BREAD-CRUMB GINGERBREAD, II

1 egg
½ cup molasses
1½ cups bread crumbs
½ cup sour milk
1 scant cup flour
1 teaspoon soda
1 teaspoon ginger
½ teaspoon cinnamon
Salt
2 tablespoons fat

Beat the egg, and add the molasses. Add the bread crumbs, which have been soaked in the sour milk. Add the flour, the soda, the salt, and the spices, which have been sifted together. Then add the melted fat, and stir the mixture thoroly. Bake the gingerbread in a moderate oven.

BREAD PUDDING

1 cup stale bread crumbs
2 cups milk
¼ teaspoon salt
1 egg yolk, slightly beaten
4 tablespoons corn sirup
Jelly or jam

Soak the crumbs in the milk until they are soft. Add the egg yolk, the sirup, and the salt, and bake the pudding for from 30 to 45 minutes in a slow oven. Spread a thin layer of jelly or jam over the top of the pudding, and cover it with a meringue made with 1 egg white, 1 tablespoon maple sirup, and ¼ teaspoon vanilla.

BROWN BETTY

2 tablespoons fat
2 cups soft bread crumbs
2½ cups apples or other fruit
½ cup corn sirup
¼ lemon or ½ orange, juice and grated rind
¼ to ½ cup water or fruit juice

Melt the fat, and stir in the bread crumbs. Put a layer of apples, rhubarb, or other fruit in season, in the bottom of a greased baking-dish, and sprinkle it with the fruit juice or water, and sirup; then add a layer of crumbs, and continue in this way until all the material is used, making the last layer crumbs. Bake the pudding for 1 hour. Cover the dish during the first part of the baking. A few seeded raisins and nutmeg and cinnamon may be used. Serve the pudding with a sauce or top milk or cream.

BREAD-CRUMB QUICK BREAD (2 LOAVES)

2 cups bread crumbs
2 cups cornmeal
2 cups buckwheat flour
6 teaspoons baking powder
½ teaspoon soda
2 teaspoons salt
2¾ cups milk
1 cup corn sirup
½ cup raisins, if desired

Mix the sifted dry ingredients and the bread crumbs. Add the sirup and the milk. Turn the dough into two greased pans, and bake it for 1½ hours in a slow oven. CHARLES TAYLOR

BREAD-CRUMB YEAST BREAD, I (2 LOAVES)

2½ cups water, scalded milk, rice water, or whey
2 cups bread crumbs
2 tablespoons corn sirup, molasses, or honey, if desired
2 tablespoons butter or other fat, if desired.
2½ teaspoons salt
½ to 2 cakes compressed yeast, or ⅜ to 2 cups potato yeast, depending on time allowed for rising
5½ cups white bread flour

Soften the yeast in ½ cup of the lukewarm liquid. Add the remaining liquid, boiling hot, to the bread crumbs, sweetening, fat, and salt. When the mixture is lukewarm, add the yeast. Add 3 cups of flour. Beat the mixture well. Add the rest of the flour slowly until the dough is stiff enough to knead. Knead the dough, and allow it to rise until it is double in bulk. Work it down, and allow it to rise until it has increased its size by one-half. Shape it into loaves, and place them in greased pans. Allow the loaves to rise until they are double in bulk. Bake the bread in a moderate oven for from 50 to 60 minutes. CLARIBEL NYE

BREAD-CRUMB YEAST BREAD, II (3 LOAVES)

4 cups bread crumbs
4 cups water, or milk and water
5 teaspoons salt
2 tablespoons molasses
1 or 2 cakes compressed yeast, depending on time allowed for rising
8 cups flour

Grind the bread in a chopper. Add 3 cups of lukewarm liquid to soften the crumbs. Then add the salt, the molasses, and the yeast, which has been softened in 1 cup of lukewarm liquid. If the bread is to be set overnight, 1 cake of yeast and 6½ teaspoons of salt should be used. Add the flour, and knead the dough thoroly, using as little flour on the board as possible. Let the dough rise for 3½ hours, or until it has doubled in bulk. Finish making the bread according to the directions given in the preceding recipe. CHARLES TAYLOR

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MARCH, 1918 FOOD SERIES LESSON 117

CEREALS IN THE DIET

MARY F. HENRY

THE HAND MILL AND THE FIRELESS COOKER USED IN THE PREPARATION OF BREAKFAST CEREALS

THE CORNELL READING COURSE FOR THE FARM HOME

SUPERVISORS
MARTHA VAN RENSSELAER
FLORA ROSE
HELEN CANON

EDITORS FOR THE COLLEGE
BRISTOW ADAMS
RUTH VAN DEMAN

War has brought an increased interest in intelligent selection of foods. Not only do we pay more attention to the cost of food as prices soar, but in our patriotic response to the appeal for large shipments of certain foods overseas we are eager to know if the substitutes recommended are in truth substitutes and if we are safe in breaking away from some of our old food customs.

This publication will, it is hoped, explain to the reader who cares to make a study of the subject, why cereals are a good and cheap food, what their deficiencies are, and to what extent other cereals may well be used to replace the wheat that is sent abroad.

CEREALS IN THE DIET

Mary F. Henry

As prices of food increase, the value of a dollar decreases correspondingly, but the need of the body for food remains the same. How can these facts be harmonized? Obviously, if the body must have the same food substances as formerly at the same cost, it must receive them from cheaper sources. If meat, for example, which contains certain materials that are necessary for the welfare of the body has become too expensive, a cheaper source of these materials must be sought. The question is: What are the cheapest foods that may be bought to supply the needs of the body. Hence there is an increasing responsibility for a wise choice of food that must be based on an intelligent understanding of the needs of the body for various food materials and of the adequacy of different foods in supplying these needs.

This publication presents a study of the value of cereals as food. Its purpose is to show: first, in what respects cereals are a cheap food; second, to what extent they may be used, and by what foods they should be supplemented in the dietary; and, third, whether it is possible to increase the use of cereals other than wheat in order to conserve a limited supply of wheat. It has become a responsibility and a necessity for the American housewife to answer many similar questions concerning the present food supply.

HOW TO STUDY THE VALUE OF A FOOD

The nutritive value of any food is determined by its ability to satisfy the needs of the body. The economic value of a food is determined by comparing it with other foods to show which furnishes the greatest amount of a given substance for a given sum of money. Consequently, a study to measure the total value of any food depends on: first, an understanding of what the body requires in the way of food; second, a knowledge of the composition of the given food in order to show how far it will go toward supplying these body needs; and, third, a comparison of the food in question with other foods in order to show which furnishes the greatest amount of the various food substances at a given cost.

Such a study will show that a food that is a cheap source of one material may be an expensive source of another material. A food that is cheap as a source of only certain definite substances needed by the body becomes expensive as soon as it is bought in an amount greater than is necessary to supply these particular needs. For example, milk is a cheap source of lime and of protein but an expensive source of iron.

It is a cheap food if bought in such amounts as will supply the necessary protein and lime for body use; if bought in larger amounts, however, in order to furnish the needed iron, it becomes expensive because iron may be had from a cheaper source.

Economy in buying food, therefore, would seem to consist in choosing different foods in such amounts that each need of the body is supplied from the cheapest source. This is not always possible, however. For example, rolled oats and whole wheat are the cheapest sources of iron, since a given sum of money will buy more iron in the form of these cereals than in the form of any other food. Does economy mean, then, that all the food iron should be bought in that form? If so, one is faced by the difficulty of eating about two and one-half quarts of cooked oatmeal or a quart of cooked wheat a day in order to obtain the required daily amount of iron. No one would call this a desirable type of economy. It is easily seen that a portion of the iron might better be included in more concentrated form, as in eggs or meat, even at the sacrifice of greater cost. Hence, true economy does not mean that a substance should be bought entirely from the least expensive source. It means that inexpensive sources for supplying various body needs should be included as abundantly as possible in a dietary, in so far as they do not interfere with other dietary considerations. Common sense must govern all choice of food.

WHAT THE BODY NEEDS FROM FOOD

ENERGY

Like any machine, the body needs fuel, which on burning gives energy for carrying on all activities — walking, running, and work of all kinds. Besides this voluntary external work, there is going on, constantly and quietly within the body, involuntary action, or what may be called internal work — the beating of the heart, the rise and fall of the chest muscles in breathing, all the business of digestion, and the keeping of the muscles tense and elastic for ready response to a call for external motion. All this means work in a very definite sense. The energy for all kinds of work is derived from three classes of foodstuffs. The first of these are the proteins, which play a conspicuous part in the composition of eggs, milk, cheese, meat, nuts, and legumes. The second are carbohydrates, which include starch and sugar. Starch is found abundantly in cereals, legumes, and certain vegetables; sugar, in fruits and vegetables and in the sugar cane and the sugar beet, from which it is extracted in pure form. The third are the fats, which are obtained from both animal and plant sources — from meat, milk, eggs, nuts, olives, cottonseed, and corn, and to a less extent from other cereals and from vegetables.

BUILDING MATERIALS

In addition to energy, the body needs building materials. It resembles a machine in requiring a supply of fuel; it is unlike a machine in being its own building and repair shop. It may actually build new tissue, as in the case of the growing child, the prospective mother, or the convalescent from an illness that results in loss of flesh. On the other hand, it may use new food material simply to replace the daily loss of worn-out material that the body discards.

The fuel foods, already named, may be used also as building substances, but of these, protein plays an especially important part, since it supplies nitrogen, which is an essential element in the composition of every living cell.

Still another group of building substances must be included, however, before the list is complete. This is the group of mineral, or ash, constituents. Ten or twelve elements belong in this group, all of which are necessary to the welfare of the body, but three of which will receive special consideration in this discussion because of the danger that they may be insufficiently supplied in the average diet. These three important mineral elements are lime, phosphorus, and iron.

With water added to the list, the needs of the body for building materials have been named.

BODY-REGULATING MATERIALS

The third need of the body is for materials that keep all the different kinds of work within the body going on so smoothly that the mind is unconscious of the processes. Altho one is not unwilling to know that the heart is beating, one does not wish to feel it beat; one wishes muscles and nerves to respond easily to orders for work; one desires to breathe easily; one wishes the digestive organs to do their work without calling attention to the process. In short, one does not wish the human machine to creak. Any material that assists the body to carry on all this work without creaking is a body-regulating material.

The foodstuffs named as fuel and building materials supply this regulative need. Without any one of the groups — proteins, fats, carbohydrates, ash, or water — the body suffers and is unable to perform all its functions. In addition, however, there is still another group, which may be called miscellaneous. It includes flavoring substances, which appeal to the appetite and so stimulate digestive processes; cellulose, sometimes called roughage or ballast, which helps to keep the intestines clean; and finally another very important group of substances called vitamines. This is a name given to substances only recently discovered,

which occur in certain foods and without which there can be neither health nor growth. This group will be discussed more fully in connection with the vitamines found in cereals.

Food, then, must supply all these body needs. The next step in the study is to determine how far cereals are able to supply these needs.

CEREALS AS FOOD

The term *cereal* is here used to include all those grains that ordinarily appear in the dietary, such as wheat, corn, oats, rice, barley, rye, or any of their products.

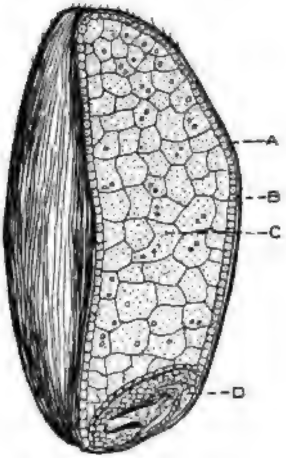

FIG. 3. DIAGRAM OF A GRAIN OF WHEAT

A, bran, consisting of five layers high in cellulose, or roughage, and ash; relatively low in starch, protein, and fat. B, aleurone layer, high in protein; often removed with the bran layers in milling. C, endosperm, high in starch imbedded in protein, low in fat and ash. D, germ, high in protein, fat and ash; often removed with the bran layers in milling

To understand clearly a discussion of the value of these grains, it is necessary to have in mind a picture of the general structure of the whole kernel showing the distribution of its different materials. Since different substances are largely confined in distinct parts of the grains, different methods of milling materially change the value of the products. For example, if the outer coats are removed in the process of milling, substances that are not contained in the inner portions of the kernel are lost. Hence it is not possible to make general statements of the value of a cereal. What may be a true statement of the value of the entire grain will not be at all true for a highly refined product of the same grain. The accompanying diagram (fig. 3) serves to make this clear. The wheat kernel has been chosen as a type because it is fairly representative of all grains.

CEREALS AS A SOURCE OF ENERGY

Just as a substance yields heat if burned outside the body, so food if burned, or oxidized, within the body yields heat. The fuel value of any food is determined by the amount of heat that it will give off when it is burned. The measure of heat is the Calorie. The energy value of any food is determined by the number of Calories that a given weight of it will yield when burned.

The energy requirement of an individual depends largely on the muscular activity of his life. The person who is muscularly active requires more energy than the person who leads a quiet, sedentary life. The following tables [1] give the energy requirement for the average adult engaged

[1] The data for tables 1 and 2 are from *Feeding the Family*, by Mary Swartz Rose.

in various kinds of activity. The calculations in table 2 are based on the weight of the average adult, 154 pounds. For a greater or less weight, the correct proportion of increase or decrease may be calculated.

TABLE 1. ENERGY REQUIRED FOR EACH POUND OF BODY WEIGHT FOR VARIOUS KINDS OF ACTIVITY

Kind of activity	Calories an hour
Sleeping	½
Sitting quietly	⅗
Standing	¾
Light exercise, such as walking	1
Moderate exercise, such as housework	1¼ to 1½
Active exercise, such as general work on a farm	1¾ to 2
Severe exercise, such as digging and lifting heavy weights	3 or more

TABLE 2. ENERGY REQUIREMENT FOR VARIOUS OCCUPATIONS

Occupation	Calories a day
In bed twenty-four hours	1,600 to 1,800
At rest, but sitting most of the day	2,000 to 2,300
Work done chiefly sitting	2,200 to 2,800
Work done chiefly standing or walking	2,700 to 3,000
Work developing muscular strength	3,000 to 3,500
Work requiring very severe effort	4,000 to 6,000

The wide difference in the amounts of energy that can be bought for a given amount of money in the form of different foods is shown in the following table.

Ten cents will buy in:	Calories
Rolled oats at $.09 a pound	2,003
Rolled oats at $.07 a pound	2,573
Rolled oats at $.05 a pound	3,606
Cornmeal at $.06 a pound	2,688
Cornmeal at $.05 a pound	3,226
Whole wheat grain at $.05 a pound	3,284
Whole wheat flour at $.08 a pound	2,041
White flour at $.08 a pound	2,001
Rice at $.10 a pound	1,591
Pettijohn's at $.15 a package	1,597

Ten cents will buy in:	Calories
Farina at $.15 a pound	1,094
Shredded wheat at $.12 a package	1,034
Puffed wheat at $.15 a package	341
Grapenuts at $.15 a package	1,031
Potatoes at $2.90 a bushel	633
Potatoes at $1.75 a bushel	1,042
Potatoes at $1.00 a bushel	1,824
Beans (navy) at $.15 a pound	1,043
Sugar at $.09 a pound	1,995
Milk at $.13 a quart	515
Milk at $.09 a quart	743
American cheese at $.32 a pound	624
Eggs at $.70 a dozen	123
Eggs at $.35 a dozen	246
Round steak at $.30 a pound	217
Cabbage at $.12½ a pound	98
Cabbage at $.04 a pound	302

Cereals in general are a cheap source of energy, but there are wide differences in the cost of the various cereals themselves. Rolled oats, the whole wheat grain, and cornmeal are the cheapest energy-yielding foods. The " ready-to-eat " and the partly cooked cereals are from two to ten times as expensive as the raw cereals. It is evident that a high price is paid for the manufacture of the ready-to-eat cereals. A bushel of wheat costing $2.50 or $3.00 is transformed into puffed wheat that sells for $28.00. Ten cents will buy more than six times as much energy in the form of whole wheat flour and more than nine times as much in the form of the whole natural grain as in the form of puffed wheat.

The difficulties that suggest themselves in the use of the entire cereal may be partly and practically solved by using a small hand mill at home for grinding cereals bought in the natural state. The hand mill and the fireless cooker offer solution for many breakfast difficulties.

Whole wheat and white flour are the cheapest of the wheat products as sources of energy. Compared with each other weight for weight, whole wheat and white flour have practically the same fuel value. This does not mean, however, that a given amount of wheat will yield the same amount of energy whether it is manufactured into white or into whole wheat flour. It has been shown that one hundred bushels of wheat will make one hundred bushels of graham flour or eighty-five bushels of whole wheat flour, but only seventy-two bushels of white flour. Hence in ordinary times a sufficient demand for graham and whole wheat flour

would increase the supply so that they could be sold at a lower cost instead of being as expensive or even more expensive than white flour. It is estimated that 18,000,000 barrels of flour could be saved to the country annually if wheat were manufactured into whole wheat flour instead of white flour. The supply of other cereals might likewise be increased by using methods of milling that would remove the least possible material of food value.

Ten cents will buy two and one-half times as much energy in the form of rice at ten cents a pound as in the form of potatoes at $2.90 a bushel, one and one-half times as much as in the form of potatoes at $1.75 a bushel, but somewhat less than in the form of potatoes at $1.00 a bushel. The substitution of rice for potatoes in the dietary is desirable from the standpoint of the energy furnished at the prices quoted in the winter of 1916–1917, but too often a comparison of this sort is made only from the standpoint of energy. A comparison on the basis of the protein and the ash contents must be made before sweeping conclusions are drawn as to the total relative values.

Sugar at nine cents a pound compares favorably with cereals as a source of energy. But sugar serves solely as an energy food; whereas cereals " throw into the bargain " along with energy-yielding substances, other substances of decided food value, such as ash and cellulose.

It is evident that succulent vegetables, such as cabbage, cannot compare with cereals as a source of energy. Their appearance in the dietary must be for reasons other than their energy yield.

Milk and eggs are expensive sources of fuel as compared with cereals. In their favor it must be said, however, that what energy they offer is in a form especially fitted for use by the body.

Taken as a class there is no cheaper source of energy than the cereals.

CEREALS AS A SOURCE OF PROTEIN

From ten to fifteen per cent of the day's total energy supply should be in the form of protein. This means that the protein in the day's food should furnish approximately from 240 to 400 Calories, or that it should weigh from 60 to 100 grams. The following table shows how much protein various foods will supply for ten cents:

	Grams of protein
Rolled oats at $.09 a pound	84
Rolled oats at $.07 a pound	108
Rolled oats at $.05 a pound	151
Cornmeal at $.06 a pound	70
Cornmeal at $.05 a pound	83

	Grams of protein
Whole wheat grain at $.05 a pound	100
Whole wheat flour at $.08 a pound	78
White flour at $.08 a pound	64
Rice at $.10 a pound	36
Pettijohn's at $.15 a package	59
Farina at $.15 a pound	33
Shredded wheat at $.12 a package	34
Puffed wheat at $.15 a package	12
Grapenuts at $.15 a package	32
Potatoes at $2.90 a bushel	17
Potatoes at $1.75 a bushel	28
Potatoes at $1.00 a bushel	50
Beans (navy) at $.15 a pound	68
Milk at $.13 a quart	25
Milk at $.09 a quart	36
American cheese at $.32 a pound	41
Eggs at $.70 a dozen	11
Eggs at $.35 a dozen	22
Round steak at $.30 a pound	29
Almonds at $.50 a pound	19
Cabbage at $.12½ a pound	5
Cabbage at $.04 a pound	16

The table indicates that rolled oats, cornmeal at the more normal price of 5 cents, and the whole wheat grain are the cheapest sources of protein; that whole wheat flour follows closely; that dried beans and white flour are not far behind; that rice and some of the ready-to-eat cereals are less expensive than eggs and nuts and milk but cost about the same as cheese and round steak: Rice at 10 cents a pound furnishes twice as much protein as do potatoes at $2.90 a bushel. Potatoes must not cost more than $1.50 a bushel in order to compare favorably in cost of protein with rice at 10 cents a pound.

As cereals are the cheapest source of energy, so they are the cheapest source of protein.

In spite of what the figures seem to indicate, certain other facts show that entire dependence should not be placed on cereals for the daily supply of protein. In the first place, it is evident, since each adult person should have from 60 to 100 grams of protein each day, that the amount of cereal necessary to supply this protein is far in excess of that which can be conveniently eaten. Eggs, milk, and meat are more expensive sources of protein than are cereals, but their form is such that they present no problem

of excessive bulk. As has been said before, this is one of the factors that must always be considered in determining true economy in choice of food.

Another fact that discounts the value of cereals as a source of protein is that the protein in cereals has been shown to be less completely digested than the protein derived from such foods as milk, eggs, and meat. This is because the protein in cereals is so closely bound up with the cellulose that the digestive juices are unable to reach and digest it entirely. Consequently a portion of it is lost to the body. The statement has been made that this loss amounts to from twenty to forty per cent of the total cereal protein. Thus it is necessary to reduce the value of the figures for the cereals in the table as much as from one-fifth to two-fifths.

Since the cellulose decreases the digestibility of the protein in cereals and since it occurs chiefly in the outer layers, there would seem to be an advantage in buying those cereals from which the bran has been removed. For example, it would seem better to buy white flour and the refined cereals rather than whole wheat flour and the coarser cereals from which the outer coats have not been removed. It must be remembered, however, that much of the protein is removed with the outer layers (fig. 3). The proteins of the more refined products are more completely digested, yet there is less protein present to be digested. Hence, as Sherman (1915)[2] states, these factors practically balance each other and the total available protein is about the same in the entire grain and the more refined grain product. Therefore the use of whole cereals in preference to refined cereals must be urged on grounds other than the protein content. As will be shown later, other valuable materials largely available for body use are chiefly in the outer layers.

A third point must be considered before the true value of the cereal proteins can be estimated. This is the fact that proteins from various sources differ in their value as food for the body. Modern investigation has shown that there is a wide difference in value.

All proteins are made up of smaller chemical units called amino acids. There are at least eighteen of these units. Proteins from various foods contain different amino acids; no two proteins contain exactly the same acids or acids in the same amounts. For body use, certain of these acids are more important than others. Without some, the animal is unable to grow; others are necessary to the very life of the animal. If one or more of these essential acids is lacking, the protein is called an incomplete protein. On the other hand, if the protein contains all the essential acids, it is called a complete protein. Several proteins of each kind have been discovered. For example, corn contains a complete protein, *glutelin*,

[2] Dates in parenthesis refer to the list of references for detailed study, page 47.

and an incomplete protein, *zein*. Wheat has been shown to contain a complete protein, *glutenin*, and an incomplete protein, *gliadin*. Milk contains two complete proteins, *lactalbumin* and *casein*. This fact explains in part the traditional superiority of milk as a protein food.

Aside from the completeness or incompleteness of a protein, still another point needs to be considered. A protein may contain, in kind, all the essential amino acids, but the proportions may not be most appropriate for use by the body. It may contain a very small amount of a certain acid that the body needs in abundance. Obviously it will not be so valuable as another protein that yields a high proportion of this amino acid. In order to supply the needed amount of this acid, a greater amount of total protein must be eaten. Therefore even the complete proteins vary in value among themselves according to their proportionate amounts of amino acids.

Experiments have been made to determine the value of different proteins in feeding animals. Cereal proteins have been compared with one another, with proteins from other plant sources, and with proteins from animal sources, and the results have shown very decided differences.

Corn proteins have shown themselves to be slightly better than wheat proteins, altho the wheat-germ proteins alone are superior to those from any other plant sources. This is an important consideration in the milling of wheat, for when white flour is made, the germ is excluded along with the bran. The fact that corn proteins hold their own in comparison with wheat proteins justifies the substitution of corn for wheat as a source of protein during a wheat shortage. Oat proteins seem to be superior to corn, wheat, or rice proteins. Rice, both polished and unpolished, is notably deficient in protein, but the protein that does exist in rice has been found to be more efficient than either corn or wheat proteins. Osborne and his collaborators (1915) say: "In its general amino acid makeup it [rice protein] more nearly resembles the majority of proteins of animal tissues than do the proteins of maize or wheat. This may explain the extensive use of rice as an almost exclusive diet in spite of its low protein content."

The efficiency of rye and barley proteins seems to have been little studied as yet, but there would appear to be good reason for their more general use.

Experiments indicate that, at least in animal feeding, mixtures of cereals are somewhat more satisfactory than any one cereal as a source of protein. McCollum and his collaborators (1917) state in recent work that unpublished data indicate "that the mixed proteins of wheat, oat, and maize fed at this plane of protein intake (10 to 11 per cent) are of satisfactory character to support fairly good growth when the rations are not otherwise deficient."

The cereal proteins are superior to the bean proteins with the exception of those in the soybean, altho the reverse opinion has been held. McCollum and collaborators (1917) say in recent work with the white bean proteins that "the evidence at present available points to the conclusion that the bean proteins are decidedly inferior to those of meat, milk, eggs, and the cereal grains which have thus far been carefully studied, *viz.*, wheat, maize, oat, and rice kernels." They (1917) further add that "it becomes imperative that beans should be combined with such other natural foods as furnish proteins which supplement these deficiencies and therefore enhance their value." Experiments carried on later with soybeans have shown that unlike the white bean, soybeans contain proteins adequate for growth. It is not unlikely that soybeans may come to play an important part in the dietary of the future.

Experiments have repeatedly pointed to the superiority of milk proteins over cereal proteins. The growing pig can utilize from two to three times as much milk protein as cereal protein; in other words, for the pig, milk proteins are from two to three times as valuable as cereal proteins. It seems not unreasonable that the human being may have a like preference for milk proteins. All experiments show the excellent supplementary effect of milk proteins on cereal proteins. The custom of combining cereals with milk or with cheese is shown, by experiments as well as by practice, to be desirable.

Egg proteins are known to be especially adaptable to conversion into body tissue. The fact that eggs contain material adequate for the development of the young chick is evidence of the superior type of the food substances that they contain.

The difference in cost between meat and cereal proteins is significant. As Sherman (1915) has pointed out, "since only a fraction of the nutrients of the grain is converted into, and retained as, body material by the animal, and scarcely half the total body weight of the animal is utilized as food for man, it is evident that meat will be a much more costly food than, for instance, the grain which if not fed to the animal might have been utilized directly as human food." Hence on the basis of cost, meat can never be an economical food to buy. As to the physiological value of the meat proteins, it is sufficient to say that while they are of superior quality, they are not indispensable in the dietary. Altho there is a place for meat in the diet, its importance has been overemphasized; aside from the cost there are physiological reasons why the quantity of meat used by the average person should be decreased, and the amount of eggs and milk increased.

In the light of this discussion it becomes clear that the tables giving the comparative cost of foods as sources of protein should be modified.

The value of milk and egg proteins should be raised; the value of cereal and bean proteins should be lowered. While cereals should indeed supply a large part of the daily protein requirement, real economy calls for reasonable quantities of milk, eggs, and meat to supplement the deficiency of cereals.

CEREALS AS A SOURCE OF LIME

Each individual requires approximately one gram of lime in the day's diet.

The following table shows the amounts of lime that ten cents will buy in the form of different foods at given prices:

	Grams of lime
Rolled oats at $.09 a pound	.655
Rolled oats at $.07 a pound	.842
Rolled oats at $.05 a pound	1.179
Cornmeal at $.06 a pound	.113
Cornmeal at $.05 a pound	.136
Whole wheat grain at $.05 a pound	.500
Whole wheat flour at $.08 a pound	.346
White flour at $.08 a pound	.142
Rice at $.10 a pound	.054
Potatoes at $2.90 a bushel	.149
Potatoes at $1.75 a bushel	.248
Potatoes at $1.00 a bushel	.434
Milk at $.13 a quart	1.250
Milk at $.09 a quart	1.810
Skimmilk at $.04 a quart	3.600
American cheese at $.32 a pound	1.559
Eggs at $.70 a dozen	.087
Eggs at $.35 a dozen	.175
Beans (navy) at $.15 a pound	.665
Carrots at $.07 a pound	.499

Rolled oats at the more normal prices of five and seven cents a pound supply more lime for ten cents than does any other food named except milk and cheese. These are by far the cheapest sources of lime. Cereals are not a cheap source of lime. It is worth noting, however, that white flour is decidedly lower in lime than is whole wheat flour at the same price. Comparison of the composition of whole and refined cereals shows a distinct loss of lime in the process of milling that is comparable to the loss in white flour as given in this table. Hence, while cereals are never a cheap source of lime, the lime derived from them would be greatly

FIG. 4. QUANTITIES OF VARIOUS FOODS FURNISHING EQUAL AMOUNTS OF LIME

Each of the foods furnishes approximately one-tenth of the amount required in the average day's dietary, or, .1 gram. Beginning at the top and reading from left to right: lettuce, spinach, onions, celery, apples, almonds, cheddar cheese, cottage cheese, round steak, cream (18 per cent), milk, egg yolk, egg, white bread, whole wheat bread, dried peas, dried beans, rolled oats, cornmeal, rice, prunes, raisins, figs, dates, oranges, bananas, pineapple

increased if the cereals containing more of the outer coats replaced the refined products in the diet. The contrast between milk with its high lime content and cereals with their low supply of lime again strikingly shows the desirability of supplementing cereals with milk.

CEREALS AS A SOURCE OF PHOSPHORUS

The daily phosphorus requirement for the human being is approximately 2.75 grams.

For ten cents the following amounts of phosphorus can be bought in the form of different foods:

	Grams of phosphorus
Rolled oats at $.09 a pound	4.39
Rolled oats at $.07 a pound	5.65
Rolled oats at $.05 a pound	7.91
Cornmeal at $.06 a pound	2.26
Cornmeal at $.05 a pound	2.72
Whole wheat grain at $.05 a pound	7.85
Whole wheat flour at $.08 a pound	5.11
White flour at $.08 a pound	1.13
Rice at $.10 a pound	.92
Pettijohn's at $.15 a package	3.96
Potatoes at $2.90 a bushel	1.31
Potatoes at $1.75 a bushel	1.72
Potatoes at $1.00 a bushel	3.01
Beans (navy) at $.15 a pound	3.44
Milk at $.13 a quart	1.59
Milk at $.09 a quart	2.31
American cheese at $.32 a pound	2.05
Eggs at $.70 a dozen	.30
Eggs at $.35 a dozen	.60
Cabbage at $.04 a pound	1.02
Cabbage at $.12½ a pound	.33
Onions at $.10 a pound	.54
Onions at $.05 a pound	1.08
Apples at $.35 for 12 pounds	.46

In contrast with their low lime content, cereals, particularly the entire kernels, contain a conspicuous amount of phosphorus. The difference in the amounts of phosphorus furnished by whole wheat and by white flour again shows the loss caused by the removal of the outer coats. Moreover, not only a large amount of phosphorus, but phosphorus in a peculiarly valuable form is removed. Phosphorus occurs in the bran in a compound

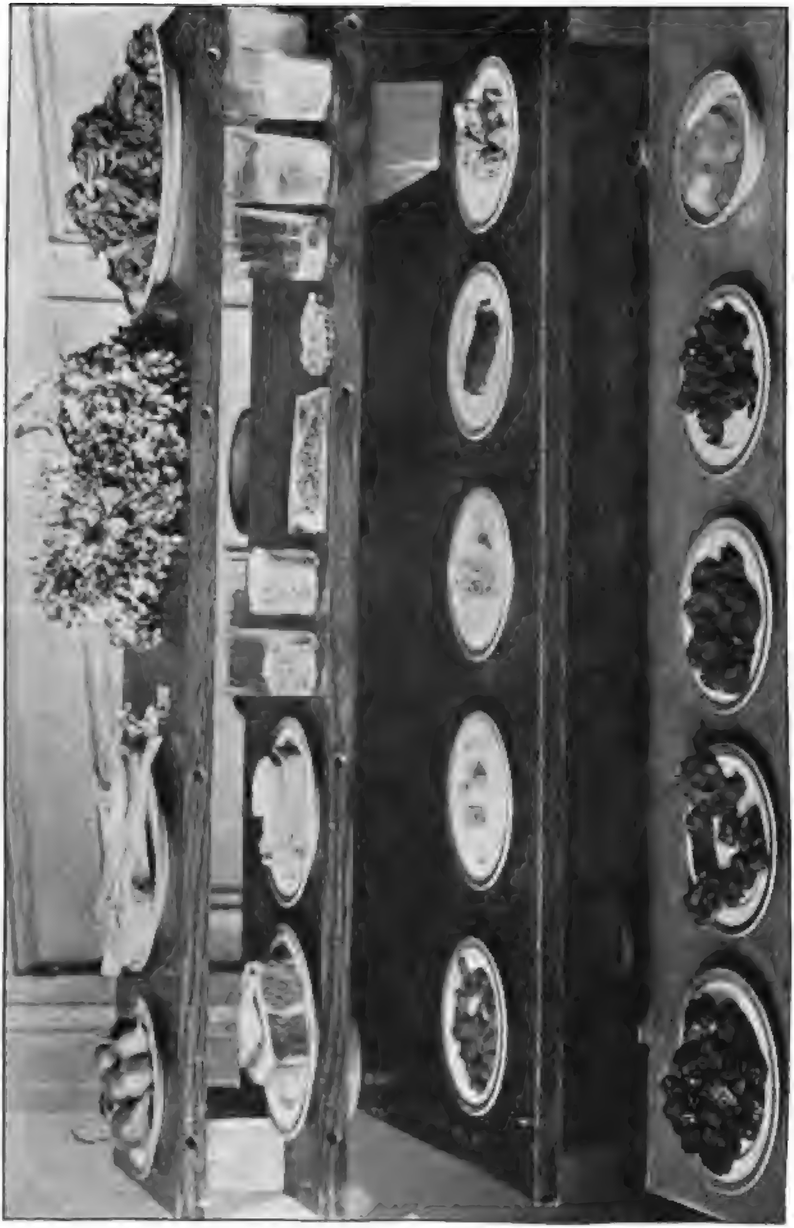

FIG. 5. QUANTITIES OF VARIOUS FOODS FURNISHING EQUAL AMOUNTS OF PHOSPHORUS

Each of the foods furnishes approximately one-tenth of the amount required in the average day's dietary, or .275 gram. Beginning at the top and reading from left to right: onions, celery, lettuce, spinach, whole wheat bread, white bread, rolled oats, rice, dried peas, dried beans, egg, cream (18 per cent), milk, almonds, cheddar cheese, cottage cheese, round steak, salmon, dates, figs, prunes, raisins, pineapple

that possesses slightly laxative properties. Like the bran itself then, it aids in keeping the intestines free from an accumulation of waste.

Rice, conspicuous for its lack of bran, is deficient also in phosphorus. Potatoes even at $3.15 a bushel would be cheaper as a source of phosphorus than rice at ten cents a pound. This means that rice is not a substitute for potatoes from the standpoint of its phosphorus content, even tho it will supply as much energy and protein as will potatoes for a given sum of money. If prices force the substitution, the loss in phosphorus should be made good by an increased use of milk and whole cereals.

Fresh vegetables and fruits evidently cannot compare with cereals in their supply of phosphorus. Milk and cheese, which are moderately cheap and are more concentrated in their phosphorus content than are cereals, are again shown to supplement cereals to advantage in supplying the day's phosphorus.

CEREALS AS A SOURCE OF IRON

Each person needs in the daily diet .015 grams of iron.

Ten cents will buy the following amounts of iron:

	Grams of iron
Rolled oats at $.09 a pound	.01804
Rolled oats at $.07 a pound	.02330
Rolled oats at $.05 a pound	.03260
Cornmeal at $.06 a pound	.00825
Cornmeal at $.05 a pound	.00990
Whole wheat grain at $.05 a pound	.04800
Whole wheat flour at $.08 a pound	.03000
White flour at $.08 a pound	.00850
Rice at $.10 a pound	.00400
Potatoes at $2.90 a bushel	.01220
Potatoes at $1.75 a bushel	.02020
Potatoes at $1.00 a bushel	.03538
Beans, navy, at $.15 a pound	.02116
Milk at $.13 a quart	.00178
Milk at $.09 a quart	.00258
Eggs at $.70 a dozen	.00282
Eggs at $.35 a dozen	.00565
Raisins at $.16 a pound	.01417
Prunes at $.20 a pound	.00651
Apples at $.03 a pound	.00465
Oranges at $.40 a dozen	.00159
Cabbage at $.12½ a pound	.00390
Spinach at $.15 a pound	.00967

FIG. 6. QUANTITIES OF VARIOUS FOODS FURNISHING EQUAL AMOUNTS OF IRON

Each of the foods furnishes approximately one-tenth of the amount required in the average day's dietary, or .0015 gram. Beginning at the top and reading from left to right: apples, pineapple, bananas, oranges, raisins, dates, figs, prunes, cornmeal, rice, rolled oats, egg, cream (18 per cent), milk, whole wheat bread, white bread, salmon, dried peas, dried beans, round steak, lettuce, spinach, celery, onions

Rolled oats, the whole wheat grain and flour, beans, and potatoes are the cheapest sources of iron. Rice and cornmeal are expensive iron foods. The contrast between the iron content of whole wheat and white flour adds to the argument for the use of whole cereals. Three-fourths of the total iron is discarded with the bran in milling, but not all of this is available in the whole wheat flour. It is estimated, however, that one-half the available iron is lost when the bran is rejected.

Potatoes, even at $2.90 a bushel, are a comparatively cheap iron food. This is especially true if the skins are eaten. Nor are potato skins unpalatable, especially those of baked potatoes.

Eggs as an iron food are more expensive than cereals. Their higher cost is very largely offset, however, by the fact that they are a more concentrated source of iron than are cereals, and that the iron contained is in an especially available form.

Milk is expensive as a source of iron, altho the small amount present is in a most available form.

Fruits and vegetables add their share to the day's supply of iron, altho not in a very cheap form. Spinach, well known to be high in iron, altho not cheap has an advantage over most of the vegetables in that it cooks down to small bulk, so that it offers a large amount of iron in concentrated form. Wild edible greens, such as dandelions, may be substituted for spinach with the result that what is expensive in the form of spinach becomes cheap in the substitute.

It is evident that in order to be inexpensive in respect to iron, a dietary must contain an abundance of whole cereals. High prices are bound to decrease the wide use of vegetables and fruits in the diet. Eggs will be more or less limited in amount. Unless whole cereals are resorted to, a very important element is likely to be deficient in the day's food supply.

CEREALS AS A SOURCE OF ROUGHAGE

The body-regulating foods have been defined already as substances that aid in keeping the body processes running smoothly. In every dietary there is needed a certain amount of roughage, or indigestible substance, that acts mechanically to keep the intestines free from an accumulation of waste matter. The cellulose of fruits and vegetables, and the coarser parts of cereals are all equally valuable in this respect. They are not equally economical, however. Again, if high prices limit the use of fruits and vegetables, the whole cereals can fortunately be substituted as sources of this indigestible, but necessary, substance.

CEREALS AS A SOURCE OF VITAMINES

The word *vitamine* is becoming a more or less popular term. It is applied to certain remarkable substances that exist in exceedingly small

amounts in certain foods, and not at all in others. If these substances are lacking in the dietary for any great length of time, growth will cease and certain diseases will occur; if the lack continues sufficiently long, disease will result in death. The presence of these substances in certain foods has been so recently discovered and their occurrence seems to be in such minute quantities that little has been known of them except thru the effect of their absence. Two classes of vitamines have been found: one is found associated with certain fats and for this reason has been called fat-soluble *A*; the other is found dissolved in the liquid part of certain foods and has been called water-soluble *B*.

Fat-soluble *A* is found in butterfat, in the fat of egg yolk, in kidney fat, in cod-liver oil, and in the more liquid portion of beef fat. It seems to be lacking in lard and in at least two of the vegetable oils, olive oil and cottonseed oil. However, in the plant world it is found in the leafy portions and stems of certain plants, such as cabbage, alfalfa, and clover. Alfalfa and clover are important sources of the vitamines found in beef fat and in butterfat, for apparently the animal body itself is unable to build this substance and must take it from forage plants. The fact that man is not designed to eat forage plants or even to eat plants used for human foods in sufficient abundance to supply this substance means that he must obtain it from other more concentrated sources, such as whole milk, butter, and egg yolk.

Cereals contain only very small amounts of fat-soluble *A*; that which does occur is chiefly in the embryo, or germ, portion of the kernel. McCollum and his collaborators (1917) have shown that the leaves of the cereal plants, oats, wheat, and maize, are several times richer in the fat-soluble *A* than are the grains of these plants. In other words, the parts of the plants whose cells are most active in carrying on processes of plant growth are especially rich in this substance that regulates these processes. The statement that whole grains contain slight amounts of fat-soluble *A* while the refined products lack it, is explained by the fact that the embryo has been removed at the same time that the outer coats of the grain are removed.

Altho the plea for whole cereals may be somewhat strengthened on this basis, yet even in the whole grains, fat-soluble *A* occurs in such small amounts that it should be supplemented by foods, such as milk and eggs, and the leaves of plants, such as cabbage, which are relatively rich in it.

Water-soluble *B* is found in many different foods. Milk and fresh fruits and vegetables contain it in abundance. Cereals are a far more important source of water-soluble *B* than of fat-soluble *A*. Experiments have shown that if fowls are fed solely on a diet of polished rice, a disease called polyneuritis is developed, which is similar to a disease called beriberi in man. It has been further shown that both diseases can be cured by

feeding the polishings of the outer coats of rice. In other words, the outer layers contain this important substance. Further experiments have shown that other whole cereals contain it in liberal amounts. While this fact again points to the superiority of entire over refined grain products, it should be said that a diet containing moderate amounts of natural foods is not likely to be lacking in water-soluble *B*, because it is thought that most natural foods contain an abundance of this substance. The whole cereals are more significant for other food substances than for water-soluble *B* that they furnish.

SUMMARY

1. Cereals and their products are in general the cheapest sources of energy in foods, altho they differ greatly in cost among themselves, according both to kind and to method of manufacture.

2. The raw cereals are much less expensive sources of energy than are the ready-to-eat cereals.

3. Whole cereal products and refined cereal products are of practically equal fuel value, but whole cereal products are superior as sources of several important food substances. A greater demand for whole cereals and their products would reduce the cost to a level consistent with the simpler process of manufacture.

4. Cereals are not so good a source of protein as their composition would indicate: they are too bulky to furnish conveniently an adequate supply of proteins; the type of proteins is not the most valuable for the body, altho it has been found that combinations of cereals, such as oats and wheat, so supplement each other that the combined protein is superior to either protein by itself; and probably only from three-fifths to four-fifths of the total protein is available for use by the body. For these reasons, cereal proteins should be supplemented in the dietary by reasonable amounts of the more available proteins, such as those of milk, eggs, and meat.

5. Probably twice as much available ash, containing lime, phosphorus, and iron, is present in the whole cereals as in the refined cereals. Since the ash constituents are confined largely to the outer coats and the germ of the kernel, the process of milling removes a large proportion of them. Cereals are never cheap sources of lime; the whole grains and their products, however, contain more lime than do the refined products. The whole cereals are important sources of phosphorus and of iron.

6. Graham bread and milk constitute a balanced meal. Milk furnishes excellent proteins and an abundance of lime and thus counterbalances the inferior proteins and the lack of lime in the cereals. Graham flour furnishes the iron that milk lacks.

7. Cornmeal or rolled oats can replace wheat and its products to advantage as a source of energy and protein when there is a scarcity of wheat. Rice is more expensive at ten cents a pound as a source of energy and protein than is wheat even at a high price, but rice may be substituted for potatoes as a source of energy and protein when potatoes are high in price.

8. As a source of lime, rolled oats are cheaper than wheat; and as a source of phosphorus, they compare favorably with wheat in price. Cornmeal is more expensive than whole wheat or white flour as a source of lime but less expensive than white flour as a source of phosphorus. Rice is more expensive as a source of these substances than are the refined wheat products. If milk is supplied rather abundantly in the diet, however, these differences may be discounted, and wheat may be replaced by other cereals.

9. As a source of iron, rolled oats compare favorably with the whole wheat products, while cornmeal and rice are more like the refined wheat products. At least the refined wheat products may be replaced by other cereals as a source of iron.

10. The whole grains and their products are important sources of two body-regulating substances, roughage and the water-soluble vitamine. The fat-soluble vitamine is present in only slight amounts. The refined cereal products are practically lacking in roughage and vitamines.

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ALBERT R. MANN, DIRECTOR OF EXTENSION SERVICE

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MARCH, 1918 FOOD SERIES LESSON 117

CEREALS IN THE DIET

DISCUSSION PAPER

Please answer the following questions, detach the sheet, and send it to the Supervisors of the Reading Course for the Farm Home, Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

1. What are you doing in your own household to help decrease the demand for wheat without decreasing the nutritive value of the dietary?

2. In what ways could you reduce the amount of money you spend for cereals without decreasing the nutritive value of the dietary?

3. In what respects are the whole cereals more valuable as food than the refined cereal products?

4. Why do graham bread and milk constitute a balanced meal, while white bread and milk do not?

Name..

Address...

Date..

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ALBERT R. MANN, DIRECTOR OF EXTENSION SERVICE
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EDITOR FOR THE COLLEGE, BRISTOW ADAMS; ASSISTANT, RUTH VAN DEMAN

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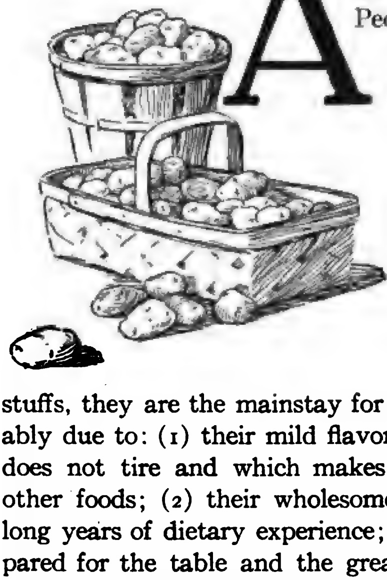
APRIL, 1918 FOOD SERIES LESSON 118

WHEN POTATOES ARE PLENTIFUL



AS LONG as the war lasts the United States will be asked to send wheat to the Allies. People will turn to other grains that are abundant and to their old stand-by, potatoes, which are among the best foods to take the place of wheat.

Potatoes are as thoroly American as the American Indian. They are raised in this country principally for food; not nearly so large a proportion is used for industrial purposes as has been customary in Europe. They are the most common vegetable on the American table, winter and summer. Next to breadstuffs, they are the mainstay for starchy food. Their popularity is probably due to: (1) their mild flavor, of which even the capricious appetite does not tire and which makes possible their combination with many other foods; (2) their wholesomeness, which has been established thru long years of dietary experience; (3) the ease with which they can be prepared for the table and the great variety of ways in which they can be served; (4) their low cost except in extraordinary years.

WHY POTATOES ARE A NUTRITIOUS FOOD

One medium-sized potato, an ordinary serving of the common cooked breakfast cereals, and a medium-sized slice of war bread contain about the same amount of energy-yielding food, principally in the form of starchy substances. Starch is one of the foods depended on for supplying the body with energy to live and to work. Among other foods that supply energy are sugar and fats, but the people of the United States

are asked to save these, as well as wheat, in order to send as much as possible abroad. They are concentrated foods and consequently adapted for shipping. Other grains than wheat are not in such demand by the Allies, nor are potatoes. Therefore the main energy-yielding foods of the people of this country for the next few years may, on occasion, be potatoes and grains other than wheat. This will mean no real hardship in any way except a possible change of food habits. The substitution will cause not the slightest impairment of health if the principles of good cooking are observed.

The potato contains only a small proportion of one type of building material that the body needs, called nitrogen; but its nitrogen compounds have been found to be of high nutritive efficiency and in approximately as large amounts, on the basis of average servings, as in cereals.

Like most other vegetables, potatoes furnish mineral salts and bulk. The salts are needed both for building the tissues of the body and for regulating its processes; the bulk, or cellulose, aids in the elimination of waste products.

As a source of iron, properly cooked potatoes are equal to the whole cereals. They furnish nearly as much iron in the average serving as do eggs, one of the best foods for iron. Spinach is the most abundant source of iron, and other green vegetables and meat are rich in it, but the whole cereals and potatoes are the cheapest sources.

Altho neither potatoes nor cereals should be depended on to supply the body adequately with lime or phosphorus, potatoes compare favorably with cereals as a source of these minerals. Since both lime and phosphorus are needed for building bones and teeth as well as for regulating body processes, they should be supplied from better and cheaper sources — lime largely from milk, and phosphorus largely from milk, eggs, cheese, legumes, and meat.

One distinct advantage that potatoes have over cereals is that they help to keep the fluids of the body neutral or slightly alkaline because of the relatively high proportion of potassium that they contain. The predominance of foods that have an alkaline reaction in the tissues seems to make for the better health of the average individual. Cereals, meats, and eggs when changed by the body for its use yield an acid product. Excess of acid produced in the body may be harmful unless it is neutralized by some alkaline substance. Vegetables, fruits, and milk yield an alkaline product and therefore should be used in sufficient abundance to counteract the effect of the acid-yielding group of foods. One medium-sized potato furnishes sufficient alkaline substances to neutralize the acids produced by one ordinary slice of lean roast beef. In this respect, then, potatoes are more than a substitute for cereals; they furnish necessary substances that cereals cannot furnish.

It is apparent, therefore, that potatoes can well take the place of a part of the wheat as far as nutriment is concerned. The chief difficulty in using them as a substitute for part of the daily wheat bread is mental. However, when potatoes are plentiful and wheat is scarce, the long-established habit of eating bread with every meal may be broken for a time with no harm to health.

QUALIFICATIONS FOR COOKING

Even experts have difficulty in judging the quality of potatoes by appearance. In general, however, a netted skin, a regular shape, and shallow eyes are marks of a good potato for cooking.

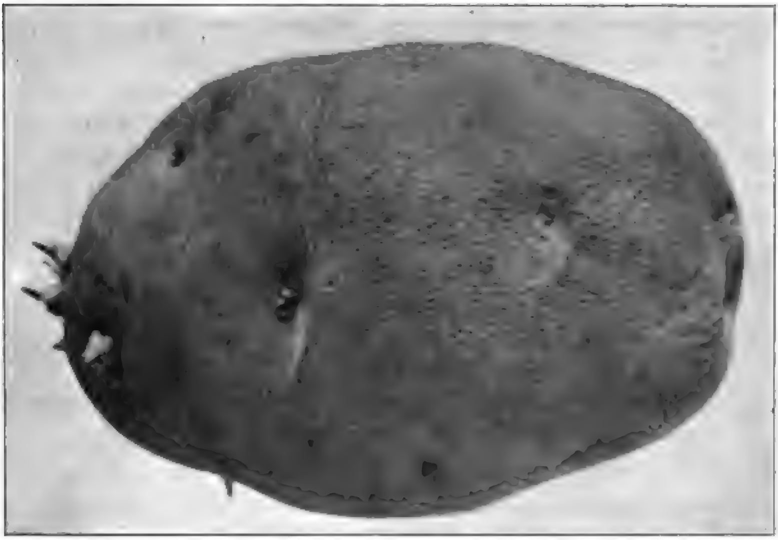


Fig. 7. A GOOD POTATO FOR COOKING
Netted skin, shallow eyes, and regular shape are characteristics of good cooking quality

The demand in the American market is for potatoes of uniform size, 3 or 4 inches in length and 6 or 8 ounces in weight. Such potatoes can be cooked uniformly without being cut, and they have a better appearance when served than do larger potatoes.

A starchy flavor is generally desired. Potatoes with a starch content of 18 or 20 per cent usually are of mealy consistency when cooked. If a potato is unduly watery, it is likely to be soggy when cooked. Both young potatoes and those that have been stored for a long time have a greater amount of cellulose, or framework, in proportion to starch than have fresh mature ones.

Waxy potatoes are often preferred to mealy ones for salad and for frying in deep fat, because they retain their shape better. This waxiness is apparently due to a larger proportion of protein to starch than is the case in mealy potatoes.

Altho there is a greater demand for potatoes with a yellowish or a whitish skin, the pink-skinned varieties are equally good for table use.

COOKING POTATOES

By the most commonly used methods of preparing and cooking potatoes, a very large proportion of the nutritious substances may be lost. From all points of view, baking and steaming are apparently the best methods, and steaming has the advantage of economy in fuel used. A potato baked in a slow oven may be inferior, however, to a potato properly boiled, because if the heat is not sufficient to cause the cell walls to be broken down, the result is a soggy mass on which the digestive juices cannot act freely. Too rapid boiling is likely to pulverize the outside of the potato before the inside becomes tender, thus causing waste and an unattractive appearance when served. The method by which potatoes are cooked deserves consideration, therefore, because it affects both the nutritive value and the pocketbook.

Losses of nutritive matter in cooking potatoes occur (1) in paring, both by cutting away valuable material and by exposing the soluble substances to the action of water in case the potato is boiled, (2) in exposing a large amount of surface to the water, as when the potato is cut in dice, (3) in soaking before cooking, (4) in putting the potatoes on to cook in cold instead of hot water, (5) in cooking the potatoes in unsalted water.

In paring a potato the loss may be as much as twenty per cent. Since the larger proportion of the valuable protein and mineral matter is in the outer layers, this loss may be serious. The waste of total substance may be about twice as great when the paring is done before boiling as when it is done afterward, because the skin tends to hold back the mineral salts, the protein, and the starch, and none of the food substance comes off with the skin after cooking. Furthermore, time is saved by paring the potatoes after cooking them, since the skin may easily be peeled off with the help of a sharp paring knife. Of course any green portion should be cut away, since the flavor is often bad. If water in which pared potatoes have been cooked is used in soups, sauces, gravies, breads, stews, or some such way, no food material need be lost in the end.

If the potato is cut in dice before being cooked, the increased amount of surface exposed will result in still greater loss of nutriment, altho if prepared just before cooking and plunged immediately into boiling water, the loss is minimized.

Old potatoes must often be soaked in cold water to remove their strong flavor and make them fit for food. Experiments have shown that a pared potato soaked for from three to five hours loses about three times as much of its mineral matter and seven times as much of its protein as one that is pared and put on to cook immediately. When potatoes are both pared and soaked, the loss in one bushel is estimated as equivalent to one pound of sirloin steak. Therefore soaking should be resorted to only when necessary for old potatoes.

The temperature of the water in which potatoes are put on to cook also influences loss of nutriment. Here again experiments prove that altho the loss of mineral matter is inconsiderable, there is over twice as great a loss of protein when potatoes are put on to cook in cold water as in boiling water.

Frozen potatoes seem to have a better flavor and texture if plunged immediately into boiling water than if allowed to thaw before being cooked.

When salt is added at the beginning of the cooking, the loss of mineral matter is reduced to about one-third of what it would otherwise be.

To sum up, if the potatoes are washed thoroly and then without being pared or soaked are put on to cook in boiling salted water, there is practically no loss. The following conclusions, then, are apparent: (1) potatoes should be cooked in such a way as to retain their valuable nutritive matter, or (2) the material extracted from them by more wasteful methods of cooking should be used in soups, sauces, gravies, and the like.

RECIPES FOR USING POTATOES

LUCILE BREWER

As every housewife knows, left-over potatoes may be used in many of the recipes here given. Often, with the addition of little or no new material, a palatable dish can be made by warming over potatoes.

BAKED POTATOES

Select potatoes of uniform size, scrub them with a vegetable brush, place them on a grate in a hot oven, and bake them for 45 minutes, or until they are tender. If they are overcooked they will be soggy rather than mealy. Crack or pierce the skin as soon as the potatoes are done, in order to let out the steam which otherwise would condense and cause sogginess.

STUFFED POTATOES

Cut baked potatoes in half, remove the pulp, mash it, add enough milk for the usual consistency of mashed potatoes, and season it with butter, salt, and pepper. Fill the cases with this mixture, dot the tops with butter or brush them with milk, and bake the stuffed potatoes for

8 or 10 minutes in a hot oven. Potatoes may be stuffed in the morning and heated for the noon or evening meal.

Variations.— To the mashed potatoes, before the cases are filled, may be added any one or a combination of the following:

a. Beaten white of egg (1 egg to 3 medium-sized potatoes)
b. Grated cheese (½ cup to 3 medium-sized potatoes)
c. Chopped meat (½ cup to 3 medium-sized potatoes)
d. Chopped parsley (1 tablespoon to 3 medium-sized potatoes)

BOILED POTATOES

Select potatoes of uniform size, scrub them with a vegetable brush, and drop them into boiling salted water. Cook them with the cover of the kettle ajar until they are tender, about 20 or 30 minutes. Drain off the water immediately, and peel off the skins with a sharp paring knife. If the potatoes are not to be served immediately, cover them with a cloth that will absorb the moisture, and place them where they will keep warm. Overcooking or standing in water makes potatoes soggy and unpalatable.

STEAMED POTATOES

Prepare the potatoes as for boiling, place them in a steamer, cover them tightly, and steam them for about 30 minutes, or until they are tender. Remove the skins, and serve the potatoes at once.

RICED POTATOES

Potatoes that are not perfect in shape or color may be steamed or boiled, run thru a ricer or strainer into a serving dish, dotted with butter, sprinkled with paprika, and served immediately; or they may be browned in a buttered baking-dish in the oven before being served.

MASHED POTATOES

Thoroly mash cooked potatoes. Add 4 tablespoons of hot milk, 1 tablespoon of butter, and a little salt and pepper, to each pint of potatoes. Beat the mixture with a fork until it is light, and pile it lightly in a hot serving dish.

POTATO CAKES

Shape mashed potatoes into small cakes. Brown them in a frying pan in a small amount of fat.

POTATO PUFF

Add beaten whites of eggs to mashed potatoes (2 eggs to 6 medium-sized potatoes). Pile the mixture lightly in a baking-dish, and bake it in the oven until it puffs and browns. The yolks of the eggs and ½ cup of grated cheese also may be added.

POTATO PIE

Line a baking-dish with a layer of mashed potatoes 1 or 2 inches thick. Fill the center with creamed fish or chicken, and cover the top with mashed potatoes. Sprinkle buttered crumbs over the top, and bake the dish in a moderate oven for about 25 minutes.

POTATO BORDER

Spread a wall of mashed potatoes 1 inch thick around the outside of a buttered pan. Remove the pan, and fill the center with creamed chicken or fish. Reheat the dish before serving it.

POTATO SOUP, I

2 cups hot riced or mashed potatoes
1 quart milk
2 slices onion
3 tablespoons butter
2 tablespoons flour
1½ teaspoons salt
Celery salt
Pepper
Cayenne
1 teaspoon chopped parsley

Scald the milk with the onion; remove the onion; add the milk slowly to the potatoes. Melt the butter; add to it the dry ingredients; stir the mixture until it is well blended. Add this to the liquid mixture, stirring it constantly, and boil the soup for one minute. Strain it if necessary, add the parsley, and serve it. Water saved from cooking celery, is a good addition to potato soup. Two cups of tomato juice and 1/16 teaspoon of soda may be substituted for 2 cups of milk.

POTATO SOUP, II

2 cups milk
1 cup mashed potatoes
1 tablespoon onion juice
1 tablespoon butter
2 tablespoons peanut butter
2 tablespoons tomato catsup

Heat the milk, and add the other ingredients with the exception of the catsup. When the mixture is thoroly heated, add the tomato catsup, and serve the soup immediately.

POTATO SOUP, III

4 medium-sized parboiled potatoes, diced
1 medium-sized onion, minced
4 tablespoons fat
3 cups boiling water
1 tablespoon cornstarch
½ cup cold water
2 cups milk
1 tablespoon minced parsley or dried celery leaves

Brown the potatoes and the onion in the hot fat. Add the boiling water, and cook the vegetables until they are tender. Add the cornstarch mixed with the cold water. Cook the mixture until there is no

taste of raw starch. Add the milk, bring the mixture to the boiling point, and add the parsley or the celery.

POTATO CHOWDER

2 cups parboiled potatoes, diced
1 cup turnip, diced
1 cup carrot, diced
1 medium-sized onion, minced
Boiling water
⅓ cup diced salt pork or 3 tablespoons fat
1 stalk celery, or 1 tablespoon dried celery leaves, or celery salt
½ green pepper or 1 pimento
1½ tablespoons cornstarch
⅓ cup cold water
2 cups hot milk
Salt, pepper

Brown the vegetables in the fat. Add sufficient boiling water to cover them. Cook them until they are tender. Add the cornstarch moistened in the cold water. Cook the mixture until there is no taste of raw cornstarch. Add the hot milk, and the salt and pepper. One cup of cold shredded fish may be added, if desired.

CODFISH BALLS

2 cups mashed potatoes
1½ cups shredded codfish (freshened slightly and boiled until soft)
1 tablespoon butter
1 tablespoon milk
1 egg

To the mashed potatoes add the codfish, the butter, and the milk. Beat the mixture until it is light. Add the egg, which has been well beaten. Drop spoonfuls of this mixture into a pan containing a small amount of fat, and brown the pats on both sides.

POTATO LOAF

2 cups mashed potatoes
4 tablespoons minced onion
2 tablespoons green pepper or pimento
½ cup canned tomato
1 egg
1 teaspoon salt
Pepper
⅓ cup ground peanuts

Mix the ingredients well. Turn the mixture into a buttered baking-dish. Brush it over with melted butter or drippings. Bake it in a moderate oven for 25 minutes.

POTATO CUTLETS

1 cup mashed or chopped potatoes
1 cup ground boiled soybeans
2 sweet red peppers, minced
1 cup bread crumbs
½ cup tomato juice
Salt, pepper

Combine the ingredients, and form the mixture into shapes like cutlets. Dip them into beaten egg, roll them in bread crumbs, place them on

a greased tin, and brown them in a moderate oven. Serve the cutlets with pimento, green pepper, or horse-radish sauce.

POTATO AND MEAT ROLLS

2 cups mashed potatoes	Salt, pepper
$\frac{2}{3}$ to 1 cup cold meat, ground or chopped	Celery salt
	Sage to taste
1 medium-sized onion	Cabbage leaves
1 green pepper or pimento	Boiling water or stock

Combine the vegetables, the meat, and the seasonings, and shape the mixture into small rolls. Roll each of these in a cabbage leaf, and place them in a covered baking-dish. Add sufficient boiling water or stock to about half cover them. Bake them for 45 minutes, or until the cabbage leaves are tender.

VEGETABLE SCALLOP

2 cups cooked potatoes, diced	Salt, pepper
1 cup boiled soybeans	2 tablespoons fat
1 cup cooked carrot, diced	2 cups tomato juice
1 medium-sized onion, minced	4 tablespoons grated cheese

Combine the ingredients, with the exception of the tomato juice and the cheese, and turn the mixture into a baking-dish. Pour the tomato juice over the top, sprinkle it with grated cheese, and bake the dish in a moderate oven for 30 minutes.

POTATOES IN FISH OR MEAT LOAF

Riced or mashed potatoes may be very satisfactorily substituted for part or all of the bread crumbs generally used in making fish or meat loaf.

FISH AND POTATO LOAF

Line a greased bread pan with a 1-inch layer of mashed potatoes. Pack snugly into the cavity $1\frac{1}{2}$ to 2 cups of cooked fish moistened with tomato

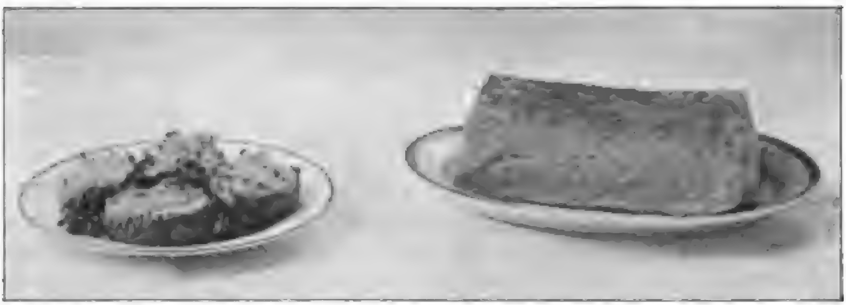


FIG. 8. STUFFED POTATOES, AND FISH AND POTATO LOAF

juice and seasoned with salt, paprika, celery salt, melted butter, and 2 tablespoons of grated cheese. Cover the dish with a layer of mashed potatoes pressed down smooth. Cover the mold, and steam it for 30 minutes. Turn it on to a hot platter, and pour white sauce (page 63) around it.

FISH HASH

3 tablespoons butter	Paprika
2 cups cold mashed or finely minced potatoes	Onion juice
⅔ cup cooked fish, shredded	1 egg
Salt	1 tablespoon milk

Melt the butter in a frying pan, and add the other ingredients except the egg and the milk. Stir the mixture until it is well heated. Press it evenly over the bottom of the pan. Beat the egg, add the milk, and spread this over the top of the hash. Brown the hash carefully on the under side. Fold it, and turn it on to a hot platter. Garnish the hash with any green, and serve it with or without a sauce.

POTATO STUFFING FOR FOWL

2 cups mashed potatoes	1 teaspoon salt
1¼ cups bread crumbs	1 teaspoon sage
¼ cup butter	1 finely chopped onion
1 egg, beaten	

Combine the ingredients, and mix them well together.

CURRIED POTATOES

4 tablespoons fat	Salt, paprika
1 tablespoon cornstarch	4 tablespoons grated cheese
2 cups milk	1 quart cooked potatoes, diced
1 teaspoon curry powder	1 medium-sized onion, minced

Make a white sauce of the fat, the starch, and the milk. Add the curry, the salt, the pepper, and the cheese. Add the sauce to the potato, and turn the mixture into a greased baking-dish. Brown it in a moderate oven for 25 or 30 minutes.

SCALLOPED POTATOES, I

Remove the skin from boiled or steamed potatoes, and cut them in slices ¼ inch thick. Arrange the slices in layers in a buttered baking-dish, covering each layer with white sauce. Sprinkle the top with buttered crumbs, and bake the potatoes for about 20 minutes. Sliced hard-cooked eggs or grated cheese may be used for variation.

WHITE SAUCE

2 tablespoons butter
2 tablespoons flour
½ teaspoon salt
Pepper
1 cup milk

Melt the butter, remove it from the heat, add the flour, the salt, and the pepper, and stir the mixture until it is smooth. Replace the mixture over the heat, add the milk, and stir the sauce until it thickens. Cook it for 15 minutes over boiling water or for 5 minutes directly over the heat, stirring it constantly.

SCALLOPED POTATOES, II

Pare potatoes carefully to prevent waste as much as possible. Slice them about ¼ inch thick, and arrange the slices in a buttered baking-dish in layers, sprinkling each layer with flour, butter, salt, and pepper. Pour milk over the top until it can be just seen thru the top layer. Bake the potatoes in a moderate oven until they are tender, from 45 to 60 minutes.

CREAMED POTATOES

Boiled or steamed potatoes may be sliced, diced, or, if small, left whole and served with white sauce.

POTATOES AU GRATIN

Put creamed potatoes into a buttered baking-dish, cover the top with buttered crumbs, and bake the dish in a moderate oven until it is brown on top, about 25 minutes.

DELMONICO POTATOES

Arrange creamed potatoes and grated cheese in alternate layers in a buttered baking-dish. Cover the top of the dish with buttered crumbs, and bake it until it is brown.

ROASTED POTATOES

Parboil potatoes for 10 minutes. Remove the skins, cut the potatoes in ½-inch slices, and sprinkle them with a little flour. Put them into a pan containing a small amount of hot fat, and cook them in an oven until they are evenly browned.

POTATO SALAD, I

6 cold boiled potatoes
4 tablespoons salad oil or melted butter
2 tablespoons vinegar
½ tablespoon salt
Cayenne pepper
2 tablespoons chopped parsley
Few drops onion juice

Cut the potatoes in ½-inch cubes. Make a dressing by mixing thoroly the other ingredients. Pour this dressing over the potatoes, and allow them to stand for 15 minutes. Drain off any dressing that may not have been absorbed by the potatoes. Garnish the salad with sprigs of parsley and serve it with cream dressing. One cup of chopped celery, 2 hard-cooked eggs, chopped or sliced, or 2 chopped cucumbers may be added.

POTATO SALAD, II

2 cups cold cooked potatoes, diced
1 cup boiled soybeans
1 small onion, minced
1 sweet red pepper, minced
Salt, paprika, celery salt

Combine the ingredients and mix them with whey salad dressing. Fold in lightly ½ cup of sour cream, whipped stiff. Serve the salad on a lettuce leaf or finely sliced cabbage.

WHEY SALAD DRESSING

1 cup whey
¼ cup vinegar
1 teaspoon mustard
½ teaspoon salt
⅛ teaspoon turmeric
2 tablespoons cornstarch
¼ cup corn sirup
Paprika
2 tablespoons butter

Heat the whey and the vinegar together. Mix all the dry ingredients, and add them with the sweetening to the whey. Add the fat, and cook the mixture until it is smooth and thick.

POTATO AND FISH SALAD

1 pint cold boiled potatoes, cut in cubes
1 cup cooked fish, shredded
3 small sour pickles, cut fine
2 green peppers, minced
1 small onion, minced
Salt
Paprika

Mix the ingredients well, and add boiled salad dressing. Garnish the salad with parsley or lettuce.

POTATO BISCUITS

1 cup mashed potatoes
1 cup flour
4 teaspoons baking powder
½ teaspoon salt
2 tablespoons butter
½ cup milk

Sift the dry ingredients. Add these to the potatoes, mixing them with a knife. Work the fat into this mixture lightly. Add gradually enough milk to make a soft dough. Toss the dough on to a floured board, pat and roll it lightly to ½ inch in thickness. Cut it with a biscuit cutter.

Place the biscuits on greased pans, and bake them for from 12 to 15 minutes in a hot oven. If other flours are used in place of wheat, the biscuits have a good taste but are not so good in appearance.

POTATO DUMPLINGS

$\frac{3}{4}$ cup mashed potatoes	1 teaspoon salt
1 cup flour	2 teaspoons butter
4 teaspoons baking powder	Milk, about $\frac{1}{2}$ cup

Mix the ingredients, and roll out the dough according to directions given for biscuits in the preceding recipe. Place the dumplings close together in a buttered steamer, place the steamer over boiling water, cover it closely, and steam the dumplings for 12 minutes.

POTATO MUFFINS

2 tablespoons butter	1 cup barley flour
2 tablespoons corn sirup	4 teaspoons baking powder
1 egg	1 teaspoon salt
1 cup mashed potatoes	$\frac{3}{4}$ cup milk
$\frac{1}{4}$ cup cornmeal	

Cream the butter, and add the sweetening; add the egg which has been well beaten, then the potatoes, and mix these ingredients thoroly. Sift the flour, the meal, the baking powder, and the salt together, and add them and the milk to the mixture alternately. Bake the muffins in greased pans for from 25 to 30 minutes.

POTATO AND CORNMEAL MUFFINS

2 tablespoons corn sirup	1 cup cornmeal
1 egg	4 teaspoons baking powder
1 cup milk	$\frac{1}{2}$ teaspoon salt
1 cup mashed potatoes	1 tablespoon butter

Add the sirup, the beaten egg, and the milk to the potatoes. Add to this the sifted dry ingredients and the butter. Bake the muffins in greased pans for 25 or 30 minutes. The muffins are somewhat more moist than when made with wheat flour; they are very delicate and excellent in flavor.

POTATO PANCAKES, I

1 egg	$\frac{1}{2}$ cup cornmeal
$\frac{1}{2}$ cup milk	3 teaspoons baking powder
1 cup mashed potatoes	1 teaspoon salt
2 teaspoons corn sirup	

Beat the egg, add the milk, the potatoes, the sirup, and the sifted dry ingredients. Bake the cakes on a hot greased griddle.

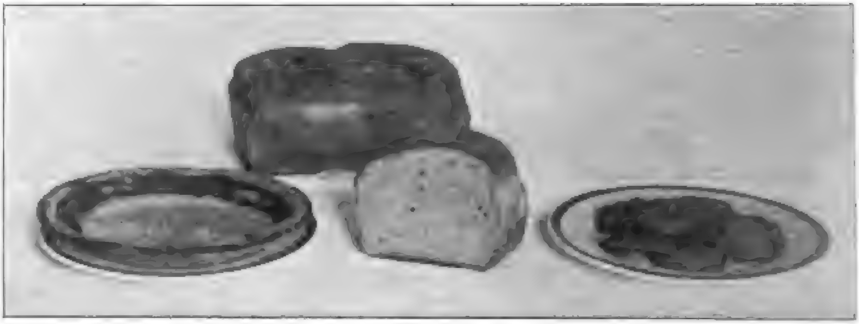


FIG. 9. PASTRY, BREAD, AND DROP COOKIES IN WHICH MASHED POTATOES WERE SUBSTITUTED FOR PART OF THE WHEAT FLOUR

POTATO PANCAKES, II

1 cup grated raw potatoes
1 teaspoon salt

Pare the potatoes because the skins give an undesirable flavor to the pancakes. About 4 medium-sized potatoes are required to fill 1 cup when grated. Add the salt to the grated potatoes. Drop the mixture by spoonfuls on a hot greased griddle, flatten out the cakes, and bake them quickly until they are well browned. These potato cakes make a good substitute for bread with a stew or a pot roast and gravy.

MRS. RAYMOND S. SMITH

POTATO PASTRY, I

½ cup mashed potatoes
½ cup flour
¼ teaspoon salt
¼ teaspoon baking powder
¼ cup fat

Sift together the dry ingredients, and combine them with the potatoes. Cut in the fat in the usual way, and roll out the pastry. This recipe makes enough pastry for a one-crust pie. The crust may be baked before the filling is added.

POTATO PASTRY, II

1 cup mashed potatoes
½ cup flour
⅓ cup fat
¼ teaspoon salt
¼ teaspoon baking powder

Follow the directions given in Recipe I. This recipe makes enough pastry for a two-crust pie. It is somewhat more moist and not quite so flaky as the crust made by Recipe I.

POTATO DROP COOKIES

2 cups mashed potatoes
2 cups corn sirup
¾ cup butter or other fat
2 cups barley flour
4 teaspoons baking powder
1 teaspoon cinnamon
¼ teaspoon cloves
1 teaspoon nutmeg
1 cup raisins
2 teaspoons salt

Mix the ingredients in the order given, and drop the mixture by spoonfuls on a slightly greased tin. Bake the cookies in a moderate oven.

POTATO BREAD (3 LOAVES)

8 cups flour
2 pounds, or 1½ quarts, potatoes, uncooked, diced
7 teaspoons salt
2 tablespoons corn sirup
2 cakes compressed yeast
4 cups water

Cook the potatoes in 3 cups of water until they are soft, mash them, and use any liquid that has not evaporated in the cooking. Combine the potatoes with the salt and the sweetening, stirring the mixture often enough to avoid the formation of any film, until it has cooled to body heat. When it is lukewarm, add the yeast which has been softened in 1 cup of water. Potato bread is better made in the short period than when allowed to rise overnight. If it is set overnight, ½ cake of yeast and 8½ teaspoons of salt should be used. Add the flour, and knead the dough thoroly, using as little flour on the board as possible. Let the dough rise for 3½ hours, or until it has doubled in bulk, at the approximate temperature of 75° F. Work it down, and let it rise again for 1½ hours, or until it has increased in size by one-half. Mold it, place it in the pans, and let it rise until it has almost doubled in bulk. Bake the loaves for 50 or 60 minutes in a moderately hot oven, or at a temperature of 360° to 400° F. Remove the bread from the pans at once, and cool it quickly.

CHARLES TAYLOR

POTATO ROLLS (3 DOZEN)

3 cups mashed potatoes
4½ cups flour
3 teaspoons salt
2 tablespoons corn sirup
1 cake compressed yeast softened in ¼ cup water
¾ cup milk, scalded
2 tablespoons butter

Add the hot milk to the potatoes, and when the mixture has cooled until it is lukewarm, add the softened yeast and other ingredients. Allow the dough to rise until it has doubled in bulk. Work it down, and let it rise until it has increased in size by about one-half. Then shape the rolls, let them rise until they are doubled in size, and bake them in a hot oven.

POTATO YEAST

6 medium-sized potatoes
¾ cup flour
⅓ cup sugar
2 tablespoons salt
¼ teaspoon ginger
1 yeast cake
½ cup lukewarm water

Scrub the potatoes, and cut them in small pieces without paring them. Cook them in boiling water until they are soft. Place all the other ingredients except the yeast cake in an earthen bowl, and strain the potato mixture over them. Add sufficient water to make a stiff batter. Cool the mixture until it is lukewarm. Add the yeast cake soaked in ½ cup of lukewarm water. Beat the mixture well. Allow it to stand for 24 hours. Use 1 cup of potato yeast to 3 cups of liquid in making bread. Keep the yeast in a cool place.

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THE CORNELL READING COURSE FOR THE FARM HOME

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JUNE, 1918 | FOOD SERIES | LESSON 119

PRESERVING VEGETABLES WITH SALT

E. L. KIRKPATRICK AND LUCILE BREWER

PACKING CABBAGE WITH SALT TO MAKE KRAUT

THE CORNELL READING COURSE FOR THE FARM HOME

1128

PRESERVING VEGETABLES WITH SALT

E. L. Kirkpatrick and Lucile Brewer

Salting, tho less used than other methods of preserving perishable vegetables, has several distinct advantages. The process is very simple, no expensive equipment is needed, and desirable flavors may be added to the product. While salting has not been widely practiced in recent years, it was formerly used by early settlers for keeping perishable produce for winter use. Owing to the present scarcity of tin and glass containers needed for canning, salting of vegetables should be given a trial in every home where surplus garden crops are available.

Since salt has the power to prevent bacterial action, many vegetables if covered with brine of sufficient strength will keep in earthenware crocks or wooden kegs until the following winter or spring without deterioration. Brines of different strength or density from those here recommended may be used. Brines weaker than ten per cent are likely to allow fermentation, as in the case of kraut, which by some persons is considered desirable because of the change in flavor that is produced. A fifteen- to twenty-five-per-cent brine may be used, but longer soaking is required for freshening vegetables packed in a solution of this strength. The strength of the brine to be used depends largely on the kind of vegetable to be stored. In general, vegetables of high water content need a stronger brine than those of low water content. The following amounts of water and salt are needed for brines of various strengths:

Water (gallons)	Salt (approximate weight in ounces)	Salt (approximate measure)	Brine (percentage)
1	1¼	3 tablespoons	1
1	2½	6½ tablespoons	2
1	3¾	½ cup	3
1	5	⅔ cup	4
1	6½	1 cup	5
1	12¾	1⅔ cups	10
1	19¼	2⅔ cups	15
1	32	4½ cups	25

Besides the vegetables discussed in this lesson, artichokes, celery, kale, onions, spinach, swiss chard, and possibly other vegetables may be satisfactorily preserved in salt. While salted products may not equal the fresh vegetables in quality, they add materially to the supply of vegetable foods thruout the winter.

DIRECTIONS FOR SALTING

String beans, kohl-rabi, parsley, swiss chard, and like vegetables will keep well when packed in alternate layers of dry salt, provided enough brine is added two days after they are packed to cover them completely.

Vegetables to be salted should be gathered when they are in the best condition for use in the fresh state, preferably just before they are fully matured. Green tomatoes, however, can be packed in salt and used later in many ways as suggested in the recipes on pages 78 to 82. All vegetables should be washed thoroly, peeled or trimmed if necessary, and packed in the container while they are crisp and tender. The top of the vegetables should be covered with a layer of grape, horse-radish, or swiss chard leaves, and the solution added. The vegetables should be weighted with a large, clean stone resting on an inverted plate, which fits closely inside the container. Molds should not be allowed to form at the top of the container, and the vegetables must be covered with brine continuously.

Cottonseed oil or melted paraffin poured over the surface of the brine to form a layer sufficiently thick to make an air-tight seal will prevent the growth of molds and aid in checking rapid evaporation of the liquid. The surface of the brine should not be covered, however, until all bubbling has ceased, which may be a week after the vegetables are packed. The container should be stored in a cool place and examined once or twice a week for several weeks.

String beans, beets, cauliflower, kohl-rabi, parsley, green and ripe tomatoes, peppers, and swiss chard preserved in dry salt or in brine of various strengths during the period September 24 to 29, 1917, were as crisp as fresh vegetables when removed from the solution February 11 to 16, 1918. The color of the vegetables except for the top layer, which had been somewhat exposed in a few of the containers, was not darkened. The flavor, tho different from that of fresh vegetables, was good, and after being freshened the salted vegetables were found to be good when cooked in various ways as well as when used uncooked in salads.

DIRECTIONS FOR SALTING VARIOUS VEGETABLES

BEANS

Use only fresh, tender beans of green- or wax-podded varieties. Snip off the ends, wash the beans, and pack them in an earthenware jar with alternate layers of salt, using one part salt to ten parts beans by weight. Weight the beans down, and two days later add enough ten-per-cent salt solution to fill the jar. When removed from the solution, the beans should be firm altho slightly darkened in color.

Beans may also be preserved in a salt-and-sugar solution as follows: Prepare selected, fresh beans as described in the preceding paragraph, and pack them in containers between alternate layers of salt and sugar, one part salt and one part sugar to seven parts beans by weight. The liquid produced by the action of the salt and the sugar on the beans should cover them in three days after they are packed. Beans preserved in this way retain their original color much better than those preserved with salt alone, but the flavor is considered by some to be less agreeable.

BEETS

Select medium-sized smooth roots, wash them, and pack them firmly in a large earthenware crock or jar. Cover them with a ten-per-cent salt solution in which one-twentieth of the water has been replaced by vinegar (about three-fourths cup vinegar to one gallon water), weight the beets down, and store the crock in a cellar where the temperature is from 45° to 60° F. When the beets are removed from the solution, they should have a natural red color thruout and be firm and of good cooking quality when freshened. Salting beets is not practical if a cool moist cellar where roots will keep without wilting is available.

CABBAGE

Kraut is made from cabbage cut into fine shreds, packed firmly into containers, and allowed to ferment. The making of kraut for home use has been practiced from ancient times to the present, and the commercial manufacture and distribution of the canned product is now an important industry.

Earthenware jars are the best containers for curing kraut. Straight-sided casks of cypress or white pine will answer in case the jars cannot be obtained, provided a layer of loose cabbage or grape leaves is placed in the bottom. Approximately seventy-five pounds of shredded cabbage (the equivalent of one hundred pounds of trimmed heads) is needed to fill a twelve-gallon container.

To make kraut for home use, choose heads of cabbage not desired for storage, cut each from its stalk just above the loose outer leaves, trim the heads, and cut them in halves lengthwise. Remove the cores with a sharp knife, and cut the cabbage into long fine shreds on a kraut-cutting board. Place a layer of shreds four to six inches deep in the bottom of the jar, and sprinkle it lightly with table salt. One pound of salt should be used to each forty gallons of kraut. Tamp or bruise the layer of cabbage with a large clean wooden weight until the cabbage appears to be juicy. Add layers of cabbage, sprinkling them with salt and bruising or tamping them, until the jar is completely filled. Cover the top of the cabbage with loose cabbage leaves that have been thoroly rinsed, fit an earthenware

or wooden cover inside of the container, and place a clean stone on it to weight down the contents as the curing progresses. Tie several layers of cheesecloth over the jar as a protection against dust and flies. Store the jar where the temperature is 55° F. or slightly above.

From four to six weeks will be needed for curing kraut at the temperature stated. If the temperature averages 70° to 75° F., less time will be needed, usually two to three weeks. Kraut is completely cured when bubbles cease to rise to the surface of the liquor and is ready for use several days or a week later. The cabbage leaves with a thin layer of softened kraut from the top of the jar must be discarded. When properly cured, kraut is rich yellow in color and may be taken from the jar as needed, if sufficient liquor is left to keep that remaining covered continually. Kraut of good quality can usually be sold on local markets in bulk or in sealed tin containers.

Sour skimmilk is sometimes used by manufacturers to hasten the curing of kraut thru the action of organisms contained in the milk. Approximately one tablespoonful of the milk to one barrel of kraut is recommended. The possibility of introducing other organisms that may hinder the growth of the natural organisms effecting curing, or that may give undesirable flavors and questionable quality to the kraut, places the use of milk open to criticism.

CAULIFLOWER

Select firm, tender heads of cauliflower and separate each into parts or branches. Wash and pack the cauliflower firmly in an earthenware jar, and cover it with a ten-per-cent salt solution in which one-twentieth of the water is replaced by cider vinegar (about three-fourths cup vinegar to one gallon water). Cover the top with a layer of chard leaves, and weight the contents under the solution.

CUCUMBERS

Cucumbers one or two inches long, known as gherkins, make excellent sweet pickles. Those three to five inches in length may be pickled as soon as gathered, or they may be put down in brine until more time is available. Use a sharp knife for harvesting and leave a short stem attached to each fruit.

To pack cucumbers in brine, place a layer of them in the bottom of an earthenware jar, and cover them with a layer of salt (ten parts cucumbers to one part salt by weight). Continue with alternate layers of cucumbers and salt, until all the cucumbers are used. Cover the top with well-washed grape or horse-radish leaves to prevent the upper layer from molding. Place a large china plate or earthenware cover on the top, and

weight it with a clean, heavy stone. After about two days, add sufficient ten-per-cent brine to cover the cucumbers completely. Remove the plate and the leaves, and add other layers of cucumbers and salt as the crop is harvested from day to day.

Another method of preserving cucumbers is to use six parts water, one part salt, and one part cider vinegar. Pack the cucumbers securely in a jar, cover them with the solution, and place horse-radish or grape leaves on the top. Weight the cucumbers with a large stone on an inverted plate.

FRESH CUCUMBER PICKLES

To make pickles from fresh cucumbers, wash and pack them in an earthenware jar. Cover them with vinegar to which has been added one cupful of salt, one cupful of sugar, and one-half cupful of mustard to each gallon. Cover the top with clean horse-radish leaves, and weight the cucumbers down sufficiently to keep them under the vinegar until they are cured.

DILL PICKLES

Dill pickles are made from firm, well-shaped cucumbers, about five inches long. Pack alternate layers of cucumbers and thin layers of dill (stalks, leaves, and seed balls) in a large earthenware jar. Cover them with a ten-per-cent brine-and-vinegar solution (two pounds salt and one and one-half quarts vinegar to three gallons water), place a layer of swiss chard or grape leaves on the top, and weight the contents down securely under the liquid. Allow the pickles to cure for three to four weeks. When the pickles are removed, they should be firm, of good quality, and ready for use.

SALTED CUCUMBER PICKLES

Remove salted cucumbers from the brine, rinse them in warm water, and soak them in cold water for three days, changing the water each day. Place the cucumbers in a porcelain-lined kettle with enough cider vinegar to cover them, and heat them to the boiling point, stirring them occasionally with a wooden paddle or spoon. Drain off the vinegar in which the pickles are heated, cover them with fresh cold vinegar, add desired spices, and allow the pickles to stand for several days or a week before using them.

KOHL-RABI

Select quickly grown, tender kohl-rabi, and remove the leaves and roots with a sharp knife. Wash the kohl-rabi, and pack it in an earthenware jar between alternate layers of salt (one pound salt to ten pounds kohl-rabi). Cover the top with grape or swiss chard leaves, and weight the kohl-rabi down securely. Three days after packing, add enough ten-per-cent salt solution to fill the jar completely.

PARSLEY

Strip parsley leaves from the stalks, wash them thoroly in cold water, pack them in an earthenware jar as firmly as possible with alternate layers of salt (approximately one pound salt to ten pounds parsley), and weight them down. Two days later, cover the parsley with a ten-per-cent brine.

PEPPERS

Select medium large, plump, green peppers. Remove the stems and enough of the tops so that the seeds can be taken out, pack the peppers in an earthenware jar, and cover them with a ten-per-cent salt solution. Cover the top with a layer of swiss chard or grape leaves, and weight the peppers down.

A salt-and-vinegar solution (ten-per-cent brine in which one-twentieth of the water is replaced with cider vinegar, or about three-fourths cup vinegar to one gallon water) may be used in place of ten-per-cent brine for preserving peppers. Peppers preserved in this solution, tho of practically the same quality, are more palatable than those held in straight salt brine.

GREEN TOMATOES

Choose well-developed green tomatoes, wash them, pack them in a container, cover them with a ten-per-cent brine, place a layer of chard leaves on the top, and weight the tomatoes down under the brine.

Green tomatoes similarly prepared and packed in salt and vinegar solution the same as that used for peppers, are good for salads and relishes.

RIPE TOMATOES

Select medium-sized ripe tomatoes free from cracks or bruises. Pack them similarly and in the same kind of solutions as recommended for green tomatoes.

CORN IN THE HUSKS

Select well-filled ears of sweet corn, and remove the loose outer husks and silks. Pack the ears between alternate layers of salt (one pound salt to seven pounds corn) in a crock, and cover and weight them securely. Several days after packing them, add enough ten-per-cent brine to fill the jar completely.

Corn cut from the cob may be packed in a ten-per-cent brine, but since dried corn is better in flavor and requires but little more labor, salting corn cut from the cob is not recommended except as an experiment.

DIRECTIONS FOR USING SALTED VEGETABLES

Salted vegetables should in general be well rinsed in cold water when removed from the brine, and then soaked in three or four times their measure of cold water to draw out the excess salt. The time necessary

for soaking varies with the kind of vegetable. If the water is changed occasionally less time will be required for soaking. They should then be drained, rinsed well, put on to cook in cold water, and brought slowly to the boiling point, after which they should be cooked slowly until they are tender, the time required being practically the same as for fresh vegetables.

BEANS

Soak salted beans for two to three hours, and cook them until they are tender, the time required depending on the condition of the beans when packed. Season them with bacon, salt pork, or butter, and serve them as fresh beans or chill them and use them in salad.

BEETS

Before using salted beets, soak them in cold water for two hours, changing the water once or twice if necessary to remove the salt. Soaking for a longer time is likely to cause loss of color. Cook the beets until they are tender, peel them, and serve them as buttered or pickled beets or use them in salads.

CAULIFLOWER

When removed from the preserving solution, cauliflower should be firm, white, of good quality, and well adapted for pickles and salads with

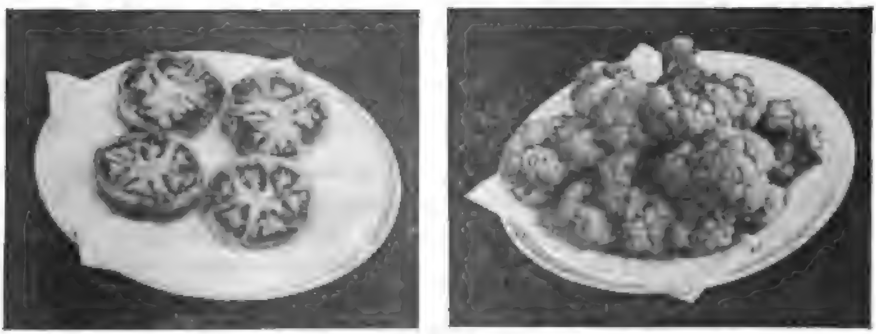

FIG. 10. SALTED GREEN TOMATOES AND CAULIFLOWER
The tomatoes were in brine and the cauliflower was in salt and vinegar solution for four months

little or no soaking. Or it may be rinsed well in cold water and cooked as fresh cauliflower.

KOHL-RABI

When removed from the preserving solution, kohl-rabi, tho rather salt to the taste, should be firm, crisp, and of good color. When rinsed, peeled, and sliced, it is well adapted for salads, or after being soaked in cold water for two to six hours it may be used as fresh kohl-rabi in soups or stews.

PARSLEY

Salted parsley when taken from the brine is well suited for flavoring soups, stews, and salads.

PEPPERS

When removed from the brine, peppers should be firm, crisp, of good color, and spicy to astringent in taste. After they are freshened for one to two hours, they are well suited for flavoring soups or stews.

GREEN TOMATOES

When taken from the jar for use, the green tomatoes packed in brine, tho probably slightly discolored, will be firm and of good quality. While salt to the taste, they should be suitable for chop pickles, or after being soaked for two hours in cold water they may be floured and browned in a small quantity of hot fat.

Green tomatoes packed in salt-and-vinegar solution should be soaked for two hours before being used. When minced very fine they are excellent added to tartar sauce, for salad or sandwiches, in the way olives are used. They also make a good conserve.

RIPE TOMATOES

When removed from either the brine or the salt-and-vinegar solution, ripe tomatoes should be firm, of good color, and palatable.

Ripe tomatoes preserved in the salt solution generally require soaking for two hours previous to being used. After this soaking the skins slip off easily, and the tomatoes can be used as tho fresh. For soups or scalloped or casserole dishes, soaking for one hour is usually sufficient, for the excess salt seasons the other ingredients.

Ripe tomatoes preserved in the salt-and-vinegar solution require soaking for only about thirty minutes. When used in combination with fresh vegetables they need not be soaked at all. The skins slip off easily, and the flesh is firm. The color and the flavor of the tomatoes are practically no different from those of fresh tomatoes. Slices of the tomatoes may be served on lettuce with sliced cucumbers.

RECIPES FOR THE USE OF SALTED VEGETABLES

GREEN TOMATO STEW

1 medium-sized onion
½ tablespoon fat
1 cup uncooked meat, diced
2 carrots, diced
1 pimento
6 medium-sized salted green tomatoes
1 tablespoon cornstarch
1 tablespoon butter
Pepper

Slice the onion, and sear it in just enough fat to prevent it from sticking to the pan. Add the meat, and sear it well. Add the carrots, the

pimento, which has been cut in small pieces, and the tomatoes, which have been soaked for two hours and cut in sixths. Add sufficient boiling water to cover the mixture, and cook it slowly until the vegetables are tender, about two hours. Then add the cornstarch, moistened in a little cold water, and the butter and pepper. Cook the mixture until it thickens, and serve it as a border around a mound of boiled hominy or hominy grits on a hot platter.

STUFFED GREEN TOMATOES

Soak salted green tomatoes for two hours. Remove a thin slice from the top of each, take out the seeds, and fill the cavity with a mixture of boiled hominy grits, barley, or rice, well seasoned with onion, paprika, and ground peanuts. Place the tomatoes in a baking dish, and add sufficient stock to almost cover them. Cover the dish, and bake it slowly until the tomatoes are tender, about one hour.

BREADED GREEN TOMATOES

Tomatoes that have been preserved either in salt or in the salt-and-vinegar solution may be used, but those from the vinegar solution have the better flavor. Soak the tomatoes in cold water for from one to two hours, and cut them in slices one-half inch thick. Roll them in bread crumbs, and then in egg, which has been slightly beaten and to which has been added two tablespoons of milk. Roll them again in crumbs, and place them in a greased pan. Brush them with melted fat, add enough boiling water to almost cover them, and bake them slowly for from forty-five minutes to one hour, or until the tomatoes are tender.

RIPE TOMATO SALAD, I

Use tomatoes that have been preserved in salt-and-vinegar solution. Soak them for thirty minutes. Peel them, and remove the stem ends and the seeds. Fill the cavities with minced green pepper that has been preserved in salt-and-vinegar solution and rinsed but not soaked, and with celery moistened with salad dressing. Place a spoonful of the dressing on top, and serve the tomatoes on lettuce or finely sliced cabbage.

RIPE TOMATO SALAD, II

Prepare the tomatoes as directed in Recipe I. Cut them about half thru in quarters. Fill them with salted string beans, which have been seasoned well with onion and salad dressing. Chill the tomatoes, and serve them either on lettuce or on a plate garnished with celery leaves.

RIPE TOMATO SALAD, III

Prepare the tomatoes as directed in Recipe I. Fill the cavities with cottage cheese seasoned with salt and paprika. Place a spoonful of mayonnaise dressing on top.

GREEN TOMATO SALAD

Soak for one hour tomatoes that have been preserved in vinegar-and-salt solution. Cook them until they are tender. Remove a slice from the top. Serve them with mayonnaise or cottage cheese salad dressing.

COTTAGE CHEESE SALAD DRESSING

½ cup cottage cheese
4 tablespoons salad oil
1 egg yolk
½ teaspoon mustard
½ teaspoon salt
Paprika

Cream the cheese thoroly, add the yolk of egg, and stir the mixture well. Add the oil and the seasoning, and beat the dressing until it is smooth and creamy.

GREEN TOMATO PIE

2 cups salted green tomatoes
⅔ cup corn sirup
2 tablespoons cornstarch
2 tablespoons butter
1 teaspoon grated lemon rind
2 teaspoons lemon juice or vinegar

Soak the tomatoes for two hours, cut them in small pieces, and cook them until they are tender. Add the other ingredients, and cook the mixture until it is thick and clear. It may be used for a two-crust pie, or it may be placed in a lower crust and covered with a meringue.

TOMATO CHUTNEY

1 pint salted ripe tomatoes, cut in small pieces
2 medium-sized onions, minced
2 salted green peppers
1 cup tart apple, diced, not pared
⅔ cup corn sirup
½ teaspoon whole cloves
1 teaspoon ground cinnamon
1⅓ cups vinegar

Peel the tomatoes, and soak them for thirty minutes. Mince the peppers; they should not be soaked. Combine all the ingredients, and cook the mixture until it is thick and clear.

GREEN TOMATO CONSERVE

1 pint salted green tomatoes
1 tart apple, diced, not pared
2 cups corn sirup
Juice of 1 lemon
Grated rind of ½ lemon

Soak the tomatoes for two hours, and dice them. Cook the tomato and the apple in a small amount of water until they are tender. Do not drain them. Add the other ingredients, and cook the mixture until it is thick and clear. If desired, about one tablespoon of preserved ginger may be added.

GREEN TOMATO RELISH

- ¼ cup salt pork, diced
- 1 small onion
- 4 green tomatoes, preserved in salt-and-vinegar solution
- 2 pimentos, diced
- 1 salted green pepper, diced
- Boiling water
- 2 tablespoons cornstarch
- ¼ cup cold water
- 1 tablespoon butter
- Paprika

Sear the salt pork well. Add the onion, which has been sliced thin, and cook it until it is light brown. Soak the tomatoes for one hour, dice them, and add them with the pimentos and the green pepper. Add sufficient boiling water to cover the mixture, and cook it until the tomatoes are tender. Thicken the mixture with the cornstarch moistened in the cold water, and add the butter and paprika. Cook the mixture until it is clear. Serve it with fish, hamburg steak, or cheese scrapple. Tomatoes that have been preserved in the salt-and-vinegar solution should be used in this recipe because of their slightly acid flavor.

MOCK MINCEMEAT

- 3 pounds salted green tomatoes
- 2 pounds apples
- 1 cup chopped suet
- 2 cups molasses
- 1 cup corn sirup
- 1 pound raisins
- 1 cup vinegar
- 1 teaspoon cloves
- 2 tablespoons cinnamon
- 1 teaspoon allspice
- 1 teaspoon nutmeg

Soak the tomatoes for two hours, and chop them fine. Chop the apples. Add the other ingredients, and cook the mixture until it is thick. This mincemeat will keep for some time in a covered jar.

GREEN PEPPER AND CELERY SALAD

Soak, for thirty minutes, peppers that have been preserved in the salt-and-vinegar solution. Cut them in halves lengthwise. Pour over equal quantities of diced tart apple and celery, a dressing made of vinegar and oil, and allow the mixture to stand for twenty or thirty minutes. Fill the peppers with the mixture, sprinkle chopped peanuts over the top, and serve them on lettuce leaves.

GREEN TOMATO AND PEPPER SALAD

Soak, for thirty minutes, peppers that have been preserved in the salt-and-vinegar solution. Soak for one hour green tomatoes that have been preserved in the salt-and-vinegar solution. Dice the peppers and the

tomatoes, and season them with minced onion and celery or celery salt. Mix boiled salad dressing with them. Serve them in cabbage-leaf cups or on lettuce leaves.

STUFFED PEPPERS

8 to 12 salted green peppers
2 cups cooked rice
⅓ cup chopped peanuts
1 teaspoon onion
¼ teaspoon sage

Soak the peppers for two hours. Boil them until they are tender. Combine the remaining ingredients, and fill the pepper cavities with the

FIG. 11. STUFFED PEPPERS AND BREADED GREEN TOMATOES MADE FROM THE SALTED VEGETABLES

mixture. Cover the tops with buttered crumbs. Bake the stuffed peppers for thirty minutes. Any kind of left-over meat may be used instead of peanuts.

MIXED PICKLE

1 pint salted string beans
2 salted green peppers
¾ cup salted corn
½ cup salted parsley
2 medium-sized onions
2 pimentos
2 teaspoons celery seed
2 teaspoons white mustard seed
¼ teaspoon paprika
2 cups vinegar
⅔ cup corn sirup
⅛ teaspoon turmeric

Soak the beans, peppers, corn, and parsley, for about two hours. Dice the peppers, and cook them with the other salted vegetables until they are tender. Add the other ingredients, and cook the mixture until it is clear.

CAULIFLOWER AU GRATIN

Rinse cauliflower that has been preserved in salt solution, and cook it until it is tender. Drain it, and cover the bottom of a greased baking-dish with a layer of the cauliflower. Add medium thick white sauce to which has been added four tablespoons of grated cheese to each cup of milk. Add another layer of cauliflower and one of sauce. Cover the top with buttered crumbs. Brown the dish in a moderate oven for about twenty minutes.

FIG. 12. SALTED VEGETABLES PREPARED FOR THE TABLE
Cauliflower au gratin, corn on the cob, parsley rolls, kohl-rabi and frankfurters

CAULIFLOWER SALAD

1 pint salted cauliflower
1 salted green pepper
1 small onion
1 pimento
Paprika

Rinse the cauliflower well, drain it, and cook it uncovered until it is tender. Drain it and cool it. Soak the green pepper, and cook it until it is tender. Mince the ingredients and combine them. Add sufficient salad dressing to moisten the mixture well, and serve the dish at once.

PARSLEY ROLLS

1 cup salted parsley, cut in small pieces
1 cup cold boiled rice, potatoes, or hominy grits
½ cup cold meat, cut fine
1 tablespoon minced onion
Paprika
¼ teaspoon celery salt
½ pimento, minced

Soak the parsley for forty minutes. Combine the ingredients, and shape the mixture in rolls three inches long. Roll them in crumbs, in egg and

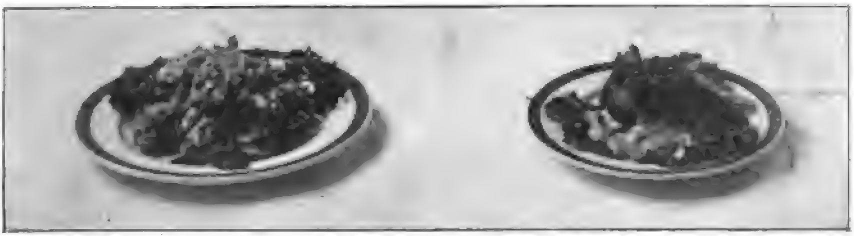

FIG. 13. SALADS MADE FROM SALTED CAULIFLOWER AND SALTED GREEN PEPPERS

milk, and again in crumbs. Place them in a greased pan, brush them with melted fat, and brown them in the oven. Serve them with tomato sauce made of two tablespoons fat, one tablespoon cornstarch, one cup strained tomato, one teaspoon onion juice, and salt and pepper.

KOHL-RABI AND FRANKFURTERS

Soak overnight kohl-rabi that has been preserved in salt solution. Cook it until it is tender. Season it with butter and pepper, turn it on a hot plate, and surround it with frankfurters cut in half and heated in boiling water for ten minutes.

OTHER PUBLICATIONS ON FOOD PRESERVATION

Food preservation: a national challenge. Cornell Reading Course for the Farm Home. Lesson 113.

Drying fruits and vegetables in New York. E. L. Kirkpatrick. Cornell Reading Course for the Farm. Lesson 132.

Preservation of vegetables by fermentation and salting. L. A. Round and H. L. Lang. U. S. Department of Agriculture. Farmers' bulletin 881. 1917.

Drying fruits and vegetables in the home. U. S. Department of Agriculture. Farmers' bulletin 841. 1917.

Mailing cards. Department of Home Economics, New York State College of Agriculture:

Jelly.
Fruit juices.
Ways of preserving beans and peas.
Ways of preserving peaches.
Ways of preserving tomatoes.

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21 The preservation of food in the home.—Part III
23 Rules for cleaning
25 Saving strength
27 Choice and care of utensils
29 Cost of food
31 Household bacteriology
39 The farmhouse
43 The box luncheon
45 Hints on choosing textiles
49 Household insects and methods of control
51 A story of certain table furnishings
53 The Christmas festival
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59 Sewage disposal for country homes
61 Attic dust and treasures
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107 Ways of using rhubarb
108 Planning the home kitchen
109 Waste of meat in the home.—Part II
112 Short cuts for the home dietitian
113 Food preservation: a national challenge
114 Principles of jelly making
115 Cornmeal once a day
116 Make every crumb count
117 Cereals in the diet
118 When potatoes are plentiful

The preceding list is correct to June 30, 1918. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

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JUNE, 1918 FOOD SERIES LESSON 119

PRESERVING VEGETABLES WITH SALT

DISCUSSION PAPER

Please answer the following questions, detach this sheet, and return it to the Supervisors of the Reading Course for the Farm Home, Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

1. To what extent and with what success have you preserved vegetables with salt?

2. Are surplus garden crops that might be salted for winter use allowed to go to waste in your community? If so, what are they?

3. If you have preserved vegetables with salt, give the directions for what you consider your best product.

4. What method have you used to prevent mold from forming on the surface of salted vegetables?

Name...

Address..

Date...

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Grass and Clover Insects

C. R. Crosby and M. D. Leonard

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GRASS AND CLOVER INSECTS

C. R. Crosby and M. D. Leonard

GRASS INSECTS

As has been pointed out by the late Professor F. M. Webster, the control of forage crop insects must differ fundamentally in method from the control of the insects of the orchard and garden. The gardener and the orchardist are able to give individual attention to their plants or trees, while the grower of forage crops must have recourse to more wholesale methods of destruction or prevent attack by such adjustments of his farm practices as will least interfere with the growing of a regular succession of crops of the desired kind. In practice this end is to be attained by a proper arrangement of the rotation, by shortening the rotation, and in some cases by plowing at the proper time for the destruction of underground insects.

While the losses to forage crops from insect attack are usually not so apparent as those experienced by the fruit grower, they are none the less real. Much of the loss is caused by insects that work in the soil, where they rarely attract the farmer's attention until after the damage is done. Altho we hear comparatively little complaint about insect injury to the hay crop it is an undoubted fact that the total loss to forage crops in New York State is much greater than that suffered by the fruit interests. It would certainly pay hay growers to give closer attention to the insect enemies of their crops. Feeding a forage crop to a host of hungry insects is even poorer economy than feeding it out to a herd of " robber " cows.

WHITE GRUBS

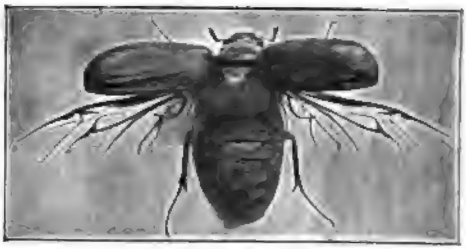
Several species of Lachnosterna

Among the most serious enemies of grasses are the large white, curved grubs that feed on their roots. These grubs (fig. 1) are the larval form of the large brown June beetles, or June bugs (fig. 2), that come blundering around our lights on summer evenings. In New York State there are over a score of species, but it is quite probable that the greater part of the injury is caused by a much smaller number.

The parent beetles are most abundant in May and June. They feed at night on the leaves of various trees, but at daybreak they desert these and return to the fields. The females burrow into the soil to a depth of two or three inches and there deposit their eggs singly or in small groups. Each female is capable of laying from fifty to one

hundred eggs. The eggs are oval, white, and have a diameter of about one-twelfth inch. They lie in small cells composed of soil particles glued together with a sticky substance secreted by the beetle. The eggs hatch in from ten days to several weeks. The young grubs feed thruout the remainder of that season on the roots of grasses a short distance below the surface of the ground. With the approach of cold weather they burrow deeper into the soil and hibernate at a depth of ten or twelve inches. The following spring they return to the grass roots on which they feed thruout the season. The grubs of some species reach maturity at the end of the second summer, but in the case of our more common species the grubs are not full grown at that time. In the latter case the grubs again descend into the soil for hibernation and return to the grass roots in the spring of the third year. After feeding for a period they become full grown in June or July. The grub then constructs an oval earthen cocoon in which it transforms to a delicate whitish pupa. The insect remains in this condition until the latter part of the summer and then transforms into a beetle. In this condition it remains in the earthen cell until the following spring, when it emerges from the ground. While certain species emerge the second spring after the eggs are laid, and a few do not emerge until the fourth spring, the greater number of our injurious species do not emerge until the third spring. For instance, in the last case the young grubs that hatch from eggs laid in the spring of 1917, feed until the fall of that year, hibernate during the winter of 1917–18, feed again thru the summer of 1918, hibernate again as grubs during the winter of 1918–19, complete their growth, pupate, and transform to beetles that season and hibernate as beetles during the winter of 1919–20; the beetles emerge in the spring of 1920. It will be seen from the foregoing account that the grubs are most destructive during the second season, because it is then

FIG. 1. A WHITE GRUB, TWICE NATURAL SIZE



PHOTOGRAPH BY SLINGERLAND

FIG. 2. A JUNE BEETLE WITH WINGS EXPANDED, NATURAL SIZE

that they feed for the longest period and make their greatest growth. The first year the grubs feed only during the latter part of the season and are very small. The third summer they feed only during the early part of the season and only enough to prepare themselves for pupation.

Control. White grub injury to grasses may be avoided in large measure by practicing a proper rotation of crops. As previously stated, the grubs do the greatest injury during the season following that in which the eggs are laid. Observations in Illinois have shown that the beetles prefer to lay their eggs in ground that is well covered with vegetation. Pasture land, wheat, and oats are chosen in the order named. Clover is a relatively immune crop, very few eggs being laid in fields where there is a heavy stand. The measures for preventing white grub injury to grasses are based on the above facts.

Unfortunately it is not possible to take advantage of the fact that the beetles avoid laying eggs on comparatively clean fields, because experience has shown that as a rule in New York the best results are to be obtained by sowing timothy with clover after wheat. But, since the clover predominates in the first year's seeding, it has a tendency to keep the beetles from choosing such fields for egg laying and thus delays the infestation of the field for a year. This practice of sowing timothy with clover would therefore appear to be justified from the standpoint of the prevention of white grub injury. In the second year's seeding, however, grasses predominate owing to the fact that most of the clover has been killed by the attacks of the clover root-borer. Such fields are then very attractive to the beetles for egg laying, and consequently the longer a field is left in grass the more seriously will it become infested with white grubs. This indicates the importance of adopting a rotation of crops in which fields are not left in grass more than two or at most three years. These measures are in line with the best agricultural practice and if adopted will not only in a large measure prevent white grub injury, but will also encourage the growing of clover, one of the most important factors in successful farming under New York conditions.

WIREWORMS

Several species of Elateridae

The size and value of the grass crop in New York State is annually lessened to a much greater degree than is usually supposed by the attacks of wireworms. Wireworms are elongate, hard-shelled, brownish larvæ (fig. 3), the immature stages of medium-sized, dull-colored, snapping beetles, or click beetles. They are underground insects that injure the plants by feeding on their roots. There are several species that injure grass in the State, the most important of which are the wheat wireworm

(*Agriotes mancus* Say), the corn wireworm (*Melanotus communis* Gyllenhal), *Drasterius elegans* Fabricius, and several others. The beetles appear in May and June, and the females deposit their eggs in the soil. The beetles are from one-third to one-half inch in length, dull grayish brown in color, and have the peculiar habit of snapping themselves into the air when laid on their backs. The young wireworms feed on the grass roots for several seasons, the various species differing in the length of their life cycle from three to six years. The wireworm larvæ reach maturity early in July. They are then from one-half to one and one-half inches in length, depending on the species. They transform to delicate whitish pupæ in earthen cells within six inches of the surface of the ground. Transformation to the beetle takes place in from three weeks to a month, the beetles remaining within the earthen cell until the following spring.

Control. Clover and buckwheat are not so subject to wireworm attacks as most other crops. When these crops are grown their presence tends to decrease the number of wireworms in the field. In grassland the amount of wireworm infestation usually increases with the length of time during which the field is left in sod. An excessive wireworm infestation may be avoided by not leaving fields in grass for more than two or three years, a measure also recommended for the prevention of white grub injury and one in line with good agricultural practice.

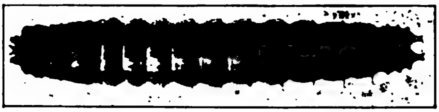


FIG. 3. A WIREWORM, TWO AND ONE-HALF TIMES NATURAL SIZE

THE ARMY-WORM

Heliophila unipuncta Haworth

Altho army-worm outbreaks occur only at intervals of several years, the insect is present in our meadows every season. The army-worm caterpillars are most abundant in low, neglected meadows. Here they live in greater or less abundance and attract very little attention until some year when conditions become unusually favorable for their increase. They then become so numerous that the food supply is quickly exhausted and the caterpillars migrate in armies devouring practically every green thing in their path (fig. 4).

Under New York conditions, the army-worm passes the winter in the caterpillar stage, usually partly grown but sometimes nearly mature. These caterpillars complete their growth in the spring and when mature burrow an inch or two into the soil and there transform to brownish pupæ about three-quarters of an inch in length. The spring brood of moths

emerge during June. The moth (fig. 5) has an expanse of about one and three-quarters inches. The fore wings are clay or fawn colored and have a distinct white spot near the center. The hind wings are brownish with black veins. The female deposits her eggs in rows of from ten to sixty on the inner side of the sheath at the base of grass or grain leaves. The eggs are covered with a white substance which fastens them together and folds the edge of the leaf around them. The eggs hatch in from six to ten days. This summer brood of caterpillars is destructive during July. The full-grown army-worm (fig. 6) is about one and one-half inches in

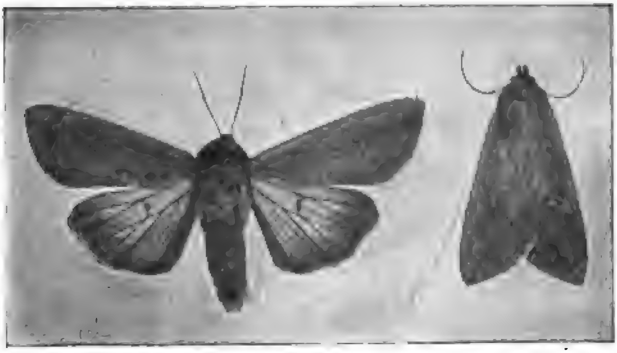
PHOTOGRAPH BY KNIGHT

FIG. 4. PASTURE DESTROYED BY ARMY-WORMS

length, of a general greenish black color, much lighter below. There are several distinct stripes on each side of the body. The caterpillars of the summer brood become mature the last of July and the first of August and give rise to a fall brood of moths that appear from the middle of August to the last of September. Caterpillars hatching from eggs laid by these moths continue feeding until the advent of cold weather, when they go into hibernation among the roots of grasses.

Control. As a grass pest the army-worm is more likely to become injurious in fields that have been for several years in sod. Trouble may be avoided by adopting a system of crop rotation by which the land is not left in sod for more than two or three years. In case the caterpillars

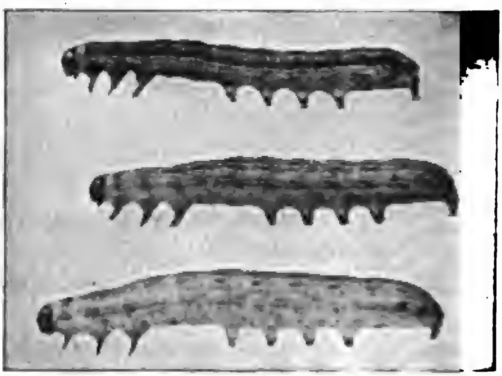
have assumed the army-worm habit, their advance may be stopped by plowing a furrow across their line of march with the vertical side of the furrow toward the crop to be protected (fig. 7). Post holes should be dug at intervals in the bottom of the furrow into which the caterpillars will fall as they crawl along while attempting to climb out of the furrow. Here they may be crushed or killed with kerosene oil.



PHOTOGRAPH BY KNIGHT

FIG. 5. ARMY-WORM MOTHS

Army-worms may also be destroyed by using a poison bait made according to the following formula: bran, 20 pounds; paris green, 1 pound; molasses, 2 quarts; oranges or lemons, 3 fruits; water, about 3½ gallons. The dry bran and paris green are thoroly mixed in a tub or similar receptacle. The juice of the oranges or the lemons is squeezed into the water; the remaining pulp and peel is chopped into fine bits and added to the water. The molasses is dissolved in the water and the bran and poison wet with it, the mixture being constantly stirred so as to dampen the mash thoroly. Only just enough water should be used to moisten the mash, but not enough to make it sloppy.



PHOTOGRAPH BY KNIGHT

FIG. 6. ARMY-WORMS SHOWING COLOR VARIATIONS

This quantity of bait will treat about three acres. The material should be scattered broadcast evenly over the infested area at nightfall. If applied during the day it dries out and is not then attractive to the caterpillars.

CUTWORMS

Several species of Noctuidae

There are several species of caterpillars closely related to the army-worm that live in grassland and which, in the aggregate, cause an enor-

mous amount of injury. They are known as cutworms from the habit that many of them possess of eating off plants at or just below the surface of the ground. Cutworms are most abundant in old sod land and attract most attention from their injuries to crops immediately following old sod.

Cutworm injury to grass crops and to crops following grass can be in large measure prevented by not leaving land in sod for more than two or

PHOTOGRAPH BY KNIGHT

FIG. 7. A FURROW ALONG THE EDGE OF A CORNFIELD TO STOP AN INVASION OF ARMY-WORMS

three years. When attacking other crops than grass, use may be made of the sweetened poison bait recommended for the army-worm.

GRASSHOPPERS

Melanoplus atlanis Riley (fig. 8), and other species

While grasshoppers are widely distributed thruout the State, they do not attract attention by their injuries except in certain years in those regions where there are large areas of sandy land. Grasshoppers are more abundant in such regions because the light sandy soil furnishes ideal conditions for the laying and preservation of their eggs.

The insect passes the winter in the egg stage in the ground. The eggs hatch in April or May, and the young grasshoppers feed on the scanty vegetation growing in sandy fields (fig. 9). They pass thru five immature stages and acquire wings at the fifth molt. Some of the grasshoppers

reach maturity about the middle of June, but others do not acquire wings until about the first of July. Whenever the food supply becomes exhausted the grasshoppers gradually spread out to new feeding grounds. Grasses, corn, oats, rye, clover, and other crops are often either completely destroyed or seriously damaged.

PHOTOGRAPH BY HADLEY

FIG. 8. GRASSHOPPER FEEDING ON A WHEAT HEAD

The grasshoppers continue to feed until the advent of cool weather, but egg laying begins the latter part of July. In depositing her eggs the female inserts her abdomen its full length into the ground. The eggs are laid in masses of from five to eighteen, arranged in several overlapping layers. The egg mass is covered with a frothy substance which hardens and protects the eggs from moisture. Small particles of soil adhere to the egg mass forming a curved pod three-quarters to over an inch in length and from one-eighth to one-quarter inch in diameter (fig. 10). Each female usually deposits two egg masses. The egg-laying period lasts six weeks or more.

PHOTOGRAPH BY HADLEY

FIG. 9. SANDY FIELD SHOWING BARE SPOTS IN WHICH GRASSHOPPER EGGS ARE LAID

Control. An effective and practical method of destroying grasshoppers is by the use of a poison bait as described for the army-worm. Fall and early spring plowing of the fields in which the eggs are deposited is also of great value and is the most important method of permanently controlling grasshoppers in New York. If the ground is also harrowed or disked, the larger proportion of the egg masses will be exposed to the

elements and destroyed. In case it is found that a large number of grasshoppers have recently hatched in a field, it would often pay to plow the field at once in order to prevent their spreading to adjoining fields. Many of them will be buried, and most of those that are not will be unable to cross the plowed land and will die of starvation.

SPITTLE INSECTS

In May or June one's attention is often drawn to curious masses of froth on the stems of various grasses. If the froth is carefully removed, a small greenish immature insect will be found resting on the stem. These insects are provided with a sucking beak by means of which they feed on the juices of the plant. More sap is taken in than can be assimilated by the insect. The excess is excreted at the tip of the abdomen as a thin, watery liquid; it there unites with a sticky substance secreted by special glands and the fluid is then mixed with air and worked into a frothy mass by a pair of appendages at the tip of the body. The frothy mass is supposed to serve as a protection for the insect against its enemies. While these curious spittle insects often attract attention and provoke inquiry, they really do very little harm and remedial measures are not necessary.

PHOTOGRAPH BY HADLEY

FIG. 10. GRASSHOPPER EGG PODS; ONE BROKEN OPEN TO SHOW THE EGGS

TIMOTHY JOINTWORM
Isosoma species

If one splits a timothy culm lengthwise, he is likely to find a small white larva one-twelfth inch in length lying in the central cavity just above one of the lower nodes (fig. 11). Sometimes the infested stems are slightly dwarfed, but more often they are the largest and rankest arising from the stool. The insect really does not injure the hay crop to any appreciable extent. Timothy grass along fences and in waste places is more liable to infestation; one-year-old seeding is infested only to a slight extent.

The insect winters in the larval state either in grass stems left along the edge of the field or those cut for hay. The insect transforms to a pupa in the stem in May, and the small, black, four-winged fly emerges the last of the month. The female fly inserts her eggs in the tender stems of the growing timothy plants, and the young larvæ feed on the pith just above a joint. There is only one brood annually.

FIG. 11. TIMOTHY JOINTWORM IN ITS BURROW IN A GRASS STEM, GREATLY ENLARGED

No remedial measures are necessary.

CLOVER INSECTS

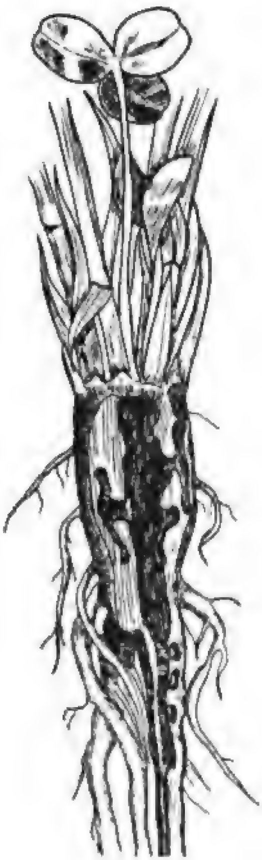
While over a hundred species of insects attack the clover plant, the greater part of the injury is caused by the seven treated in this bulletin. No part of the plant is exempt from attack: the roots are riddled by the burrows of the root-borer; the stem-borer tunnels the stems; the leaves are devoured by several weevils and caterpillars; plant lice suck the juices from the plant above ground and mealy bugs cause a similar injury to the roots; a maggot destroys the ovary of the unopened flower, and a grub devours the kernel of the seed; and even clover hay is often injured to a considerable extent by the clover hay-worm. While insect injury to clover does not often attract the grower's attention, it is none the less real and constant. If it were possible to exclude the injurious species from our clover fields not only would the crop of hay and seed be greatly increased but it would also be possible to keep the fields in clover for several successive years. The root-borer has made the clover plant for all practical purposes a biennial instead of a perennial. Many clover insects also attack alfalfa, vetch, peas, and other plants of the same family.

THE CLOVER ROOT-BORER

Hylastinus obscurus Marsham

Undoubtedly the most serious insect enemy of clover in New York State is this small brownish black beetle which in both the larval and adult stages burrows in the roots of the plant. The insect is a native

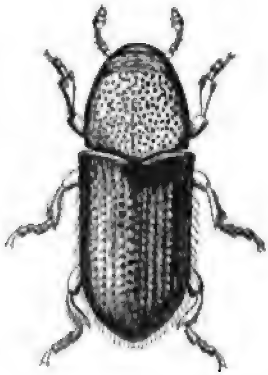
of Europe, where it has been known as a clover pest for over a century. It was probably introduced into New York State in the late seventies and first attracted attention by its destructive work in Yates County in 1878. The introduction of this pest has had an important effect on clover-growing in the State because where the insect is present it has not been found practicable to keep fields in clover longer than the second summer after seeding.



REDRAWN AFTER WEBSTER

FIG. 12. CLOVER ROOT, SHOWING WORK OF THE BORER

In addition to red clover, the clover root-borer also attacks mammoth clover, alsike, and to some extent alfalfa and peas.



REDRAWN AFTER WEBSTER

FIG. 13. THE CLOVER ROOT-BORER BEETLE

If one digs up a two-year-old clover root in late fall or early spring it will be found hollowed out by the longitudinal burrows of a small brownish black beetle about one-tenth inch in length (figs. 12 and 13). The insect passes the winter mostly in the beetle stage altho occasionally a few of the grubs are found. In May or June the beetles leave the roots and fly to other clover plants, preferably those just beginning their second year of growth. The beetles usually burrow down thru the crown, but they may occasionally enter the root from the side. The female deposits her minute, white, elliptical eggs along the side of her burrow, covering them with bits of refuse. The eggs hatch in a few days, and the young grubs burrow lengthwise thru the root, most of them becoming full grown the last of July, altho some do not reach maturity until September. The full-grown grub is about one-eighth inch in length, white, with a yellowish head and brown jaws. It transforms to a white pupa at the end of its burrow. Most of the pupæ change to beetles before the first of October. There is only one generation annually. When the root is badly infested the plant is severely injured, and if dry weather ensues the top will wither and die. Even under the most favorable conditions the growth is badly stunted and the quantity of seed produced is greatly decreased.

Control. Under the system of clover growing practiced in New York little can be done to prevent injury by the root-borer. Something may be gained, however, by adopting a short rotation, by keeping the soil in good tilth, by maintaining a high state of fertility, and by underdraining wherever necessary.

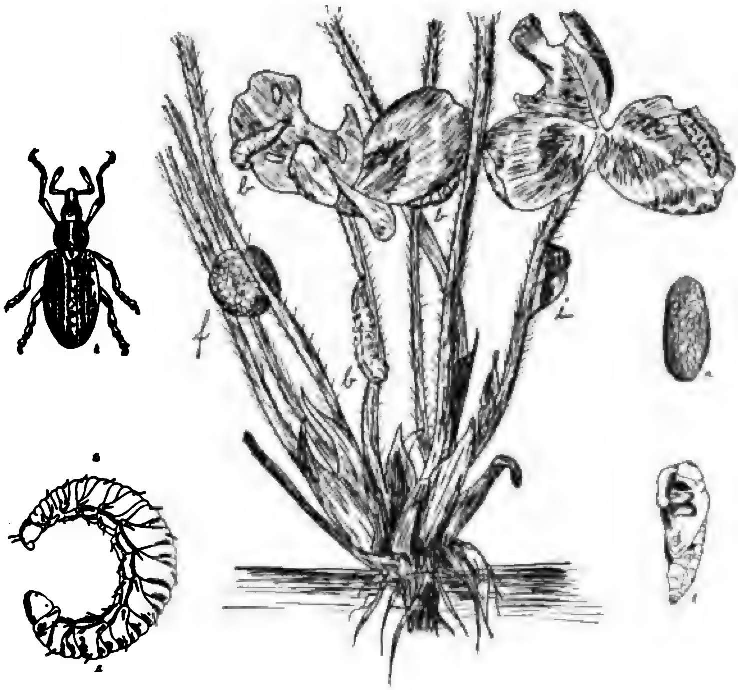
THE CLOVER LEAF-WEEVIL

Hypera punctata Fabricius

While capable of doing serious injury under favorable conditions the clover leaf-weevil does not as a rule cause so much loss as the clover root-borer. This beetle is a native of Europe and was apparently introduced into North America about the middle of the nineteenth century, but did not attract attention by its injuries to clover until the early eighties when it was reported as destructive in Yates County, New York. It is now widely distributed thruout the State and every year causes more or less loss, altho serious outbreaks are usually local in extent and rarely continue from year to year in the same locality.

The insect passes the winter in the larval condition, most of the larvæ being in the earlier stages. With the advent of warm weather in the spring these grubs begin feeding on the clover leaves and complete their growth by about the middle of June. The full-grown larva is one-third to one-half inch in length, green in color with a light stripe down the middle of the back; the head is brownish. The grubs feed mostly at night and during the day can be found curled up under the rubbish around the base of the plant. The younger grubs eat small holes thru the leaves, and the older ones devour larger areas, beginning at the edge of the leaf. When full grown, the grubs spin curious openwork cocoons of yellowish to brownish silk within which, after a few days of preparation, they transform to greenish pupæ with black eyes and yellowish legs and wing pads. The cocoons are found just under the surface of the soil or occasionally at the base of the green stems. Most of the beetles emerge during the latter part of June. The beetle is about one-half inch in length, brownish in color; the prothorax is marked with three pale lines and the wing covers with small black spots; along the outer edge is a pale yellowish stripe and occasionally one along the middle. During the daytime the beetles remain sluggish under débris on the ground. At night they feed on the clover leaves, beginning at the margin and eating toward the middle, usually leaving only the bases of the larger veins, but often, in cases of severe infestation, devouring the whole plant down to the ground. Egg laying does not begin until the latter part of August, and it takes place usually at night. At this time the beetles insert their elongate oval eggs about one-twenty-fifth inch in length into the clover stems; occasionally they

are placed between the stems at the base of the plant. A female is capable of laying forty or more eggs. The eggs hatch in about four weeks, and the young grubs spend the winter in rubbish about the base of the plants. Rarely the insect spends the winter in the egg stage and sometimes as a beetle, but these beetles are so weakened by spring that they die without laying eggs. There is but one generation annually.



REDRAWN AFTER RILEY

FIG. 14. THE CLOVER LEAF-WEEVIL: (*a*) EGG; (*b*) LARVÆ FEEDING; (*c*) RECENTLY HATCHED LARVA; (*f*) COCOON; (*h*) PUPA; (*i*) BEETLE; (*k*) BEETLE, DORSAL VIEW

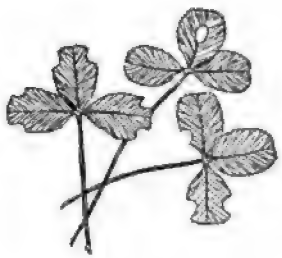
Control. Fortunately the clover leaf-weevil is in large measure held in check by a parasitic fungus that attacks the young larvæ and kills them in great numbers. No practicable method of artificial control has been devised.

THE LESSER CLOVER LEAF-WEEVIL

Sitona flavescens Marsham

The destructive work of the clover leaf-weevil last treated is augmented by a related species of similar habits. This lesser clover leaf-weevil occurs abundantly thruout New York State where it attacks red clover and alsike. It is said to have a special fondness for white clover. The

insect passes the winter in the larval state, either in the stems close to the crown or in the roots. Most of the grubs become only partially grown in the fall and complete their growth in the spring. The mature larva is one-fifth inch in length, yellowish white in color; the head is yellowish brown with whitish lines. The larvæ become full grown during the latter part of May and transform to delicate, pale yellowish pupæ in small earthen cells in the ground near the base of the plant. The beetles emerge in from two to three weeks but do not lay their eggs until September. The adult insect is a small dark brown or rusty brown snout beetle, slightly over one-fifth inch in length. In feeding, the beetle eats out a semicircular area either on the edge of the unopened leaflet or on the mid-rib; when the leaf unfolds the injury appears either as a circular hole in the center of the leaflet, or as symmetrical notches along the edge (fig. 15). The eggs are about one-sixteenth inch in length, white to blackish in color, and are deposited by the female at the base of the stems or among the roots. The eggs hatch in from two weeks to a month, and the young grubs become partly grown before the advent of cold weather. In addition to the injury to the foliage done by the feeding of the beetles the grubs injure the roots and the base of the stems so as often to cause the wilting of the plant.



REDRAWN AFTER FOLSOM

FIG. 15. CLOVER LEAVES SHOWING THE CHARACTERISTIC INJURY OF THE LESSER CLOVER LEAF-WEEVIL

While the lesser clover leaf-weevil is generally distributed and occurs in considerable abundance, its injuries have never been of such a nature as to call for special remedial measures.

THE CLOVER STEM-BORER

Languria mozardi Latreille

The stems of mammoth and of medium red clover are often hollowed out by a yellowish grub that feeds on the pith. While the presence of this larva does not kill the stem outright, it does weaken the plant to a considerable extent, increasing the tendency to lodge and decreasing the quantity of seed produced.

The parent insect is a beautiful, slender, reddish beetle with dark blue wing covers from one-sixth to one-third inch in length. The beetles pass the winter hidden away under rubbish. In May and June the females deposit their eggs in the stems of clover plants more than one year old. When preparing to oviposit the female first eats a small hole into the stem,

and then forces the egg down into the pith. The egg is about one-fifteenth inch in length, pale yellowish in color, elliptic oval in outline, and slightly curved. The eggs hatch in from three to five days, and the young grubs burrow thru the stem, eating only the pith. The full-grown larva is yellowish in color and about one-third inch in length. Most of the larvæ become mature during late July and early August. They pupate in their burrows and the beetles emerge the same season, going into hibernation with the advent of cold weather.

The clover stem-borer is not restricted to clovers, but also attacks many common weeds. It is most abundant in volunteer clover plants growing in neglected fields and along roadsides.

Remedial measures have never been found necessary for this pest since the grubs are destroyed in great numbers whenever clover is cut at the proper time.

THE CLOVER-SEED CHALCID

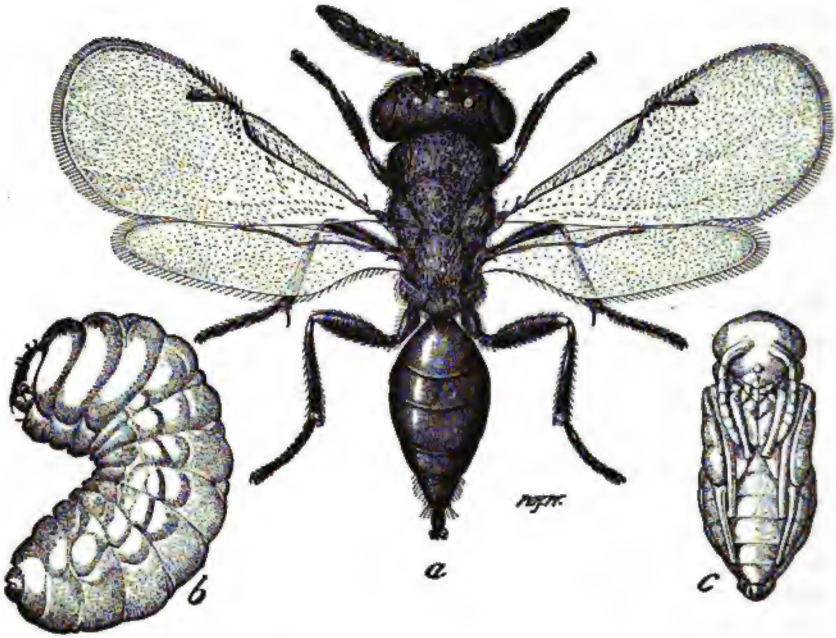
Brucophagus funebris Howard

The depredations of three insects — the clover-seed chalcid, the clover flower-midge, and the clover-seed caterpillar — render the production of clover seed very uncertain, and consequently greatly increase the cost of raising this crop. The first of these is probably, on the whole, the most injurious, altho it often happens that the second is more destructive.

The clover-seed chalcid is abundant thruout the State. The adult insect is a small four-winged fly (fig. 16, *a*), slightly less than one-twelfth inch in length, black in color with parts of the legs yellowish brown. At least fifty per cent of the crop is, on the average, annually destroyed by this pest. The clover-seed chalcid is also the most serious pest with which the grower of alfalfa seed has to contend.

On close examination the flies will be found on the clover heads thruout the season. The female is provided with a sharp needle like ovipositor with which she inserts an egg thru the floral envelope directly into the kernel of the unripe seed. This minute egg has a remarkable shape, being broadly ovate and provided with a long slender pedicel, or handle, about twice as long as the egg. From the egg there hatches a small grub that devours the entire contents of the seed and when mature (fig. 16, *b*) occupies nearly the whole cavity. Pupation takes place within the seed, and the adult fly emerges by gnawing a small, round hole thru the seed coat. Infested seeds have an abnormal appearance, being dull brown, often misshapen, and a little undersized. The insect may reach maturity and the adults emerge from the seeds within three weeks after the eggs are laid, but the period is usually much longer. Emergence is very irregular, depending in large measure on the conditions of temperature and

moisture. It has been found that the adults appear in maximum abundance in June and again in August. From eggs laid by the June brood of flies, adults will continue to emerge from July thruout the remainder of the season and some will hold over until the following May and June. The greater proportion, however, emerge during August of the same year. From eggs laid in August some adults will emerge the same season, but



U. S. DEPARTMENT OF AGRICULTURE

FIG. 16. THE CLOVER-SEED CHALCID: (*a*) ADULT; (*b*) LARVA; (*c*) PUPA

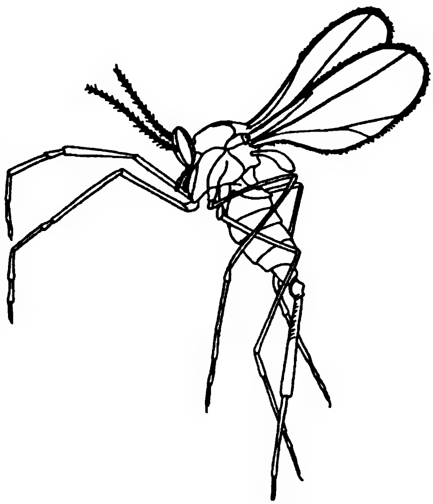
most of them do not emerge until the following spring and a few may not emerge until the following August.

Control. If the grower intends to harvest a crop of clover seed, the first crop should be cut rather early, as soon as the field comes into bloom, so as to prevent the development of a large proportion of the early brood of insects and thus decrease the size of the second brood. If the newly seeded clover has a heavy bloom it would pay either to cut or to pasture this off in the fall in order to reduce the number of chalcis flies emerging in the field the following spring.

THE CLOVER FLOWER-MIDGE

Dasyneura leguminicola Lintner

The clover midge is generally distributed thruout New York, where it is one of the most important causes for the failure of the seed crop. It was first discovered in the vicinity of Albany in the late seventies. This pest is usually associated with the clover-seed chalcid, and it is often difficult to determine which is responsible for the greater part of the damage.



REDRAWN AFTER WEBSTER

FIG. 17. THE CLOVER FLOWER-MIDGE, FEMALE

The parent insect is a minute, delicate, two-winged fly about one-twelfth inch in length. The head and thorax are black and the abdomen reddish. The flies appear in the clover fields when the plants are beginning to head. The female (fig. 17) is provided with an extensile ovipositor at the tip of the abdomen by means of which she is enabled to insert her minute yellowish to orange eggs down into the flower head, where they are glued to the hairs of the calyx tube. The eggs hatch in about three days, and the young maggot works its way between the petals of the unopened flower, enters the ovary, and devours its contents. The infested flower buds remain aborted, and the corolla usually does not open. If a large proportion of the flower buds are infested, the head remains green or becomes distorted. The larvæ feed during June and emerge from the heads about the first of July. The mature maggots are about one-twentieth inch in length and white to orange in color. On leaving the heads they descend to the ground where most of them spin cocoons within which they pupate. The insect remains in the pupal state for about three weeks. The flies of the second brood are most abundant during the last week of July and the first half of August. A large proportion of the larvæ of the second brood leave the heads and hibernate in the ground, but some of them remain in the clover heads. There are two full generations annually in New York, and there is thought to be a partial third brood in some years.

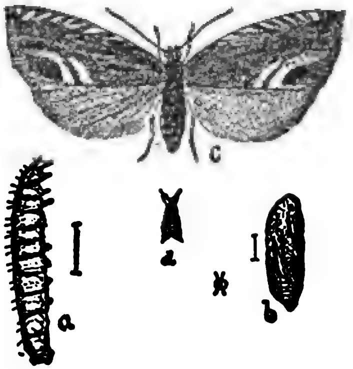
Control. In case the grower desires to harvest a crop of seed the hay crop should be cut rather early, by the middle of June. This will destroy a large proportion of the first brood of the clover blossom-midge and will

cause the second crop of clover to mature earlier and thus be past the susceptible stage when the second brood of flies appears during the last of July. Fortunately the early cutting of the hay crop is a good practice for other reasons.

THE CLOVER SEED-CATERPILLAR

Enarmonia interstinctana Clemens

Another serious enemy of clover seed is a small dirty white caterpillar that feeds in the flower heads, the clover seed-caterpillar (fig. 18). This pest is widely distributed in New York State, is usually abundant and occasionally very destructive. The parent moths appear in our fields during the latter part of May, remaining on the wing for about a month. The moth has an expanse of about one-third inch. The fore wings are brownish in color, and each has along its front margin eight oblique silvery white marks. On the posterior margin are two nearly parallel curved marks which, when the wings are closed, form, with those on the other side, two conspicuous silvery crescents. The female deposits her nearly circular, slightly flattened, greenish eggs on the green flower heads. On hatching, the young caterpillar eats its way into the head where it feeds upon the unopened flower buds and the tender green seeds, usually spoiling the whole head. The full-grown caterpillar is about one-third inch in length, dirty white in color, and is often tinged with greenish or orange. The caterpillar reaches maturity in about a month and transforms into a small brownish pupa within a silken cocoon in its burrow. A second brood of moths flies during the latter part of July, and a third brood appears in September. There are therefore three generations annually. The insect usually hibernates in the pupal stage.



AFTER OSBORN

FIG. 18. THE CLOVER SEED-CATERPILLAR: (*a*) LARVA; (*b*) PUPA; (*c*) MOTH, ENLARGED; (*d*) MOTH, NATURAL SIZE

Control. The principal injury to the seed crop is caused by the second brood of caterpillars working in the green heads. Since the flight of the second brood of moths occurs at the time when the greatest number of clover seed-midges are on the wing, the same measures will be found effective for the control of both.

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A. R. Mann, Director of Extension Service

How to Select Laying Hens

O. B. Kent

Published and distributed in furtherance of the purposes provided for in the
Act of Congress of May 8, 1914

A GOOD TYPE OF LAYING HEN

This hen began laying October 15, 1916. Her record up to September 5, 1917, was 203 eggs. Note the pale color of the beak, the ear lobes, the face, and the shanks; the old unmolted, ragged plumage; the full, bright, waxy comb; the full ear lobes; and the deep abdomen

HOW TO SELECT LAYING HENS

O. B. Kent

A fowl that is in laying condition must of necessity have a good appetite. Naturally, then, she consumes a large quantity of food each day. In order to accommodate this large quantity of food, the intestines must be large and elastic as compared with the period when she is not laying and hence not eating heavily. Careful measurements have shown that the intestines about double their dormant size during periods of heavy production. This increase in size is due to a stretching of the walls, and not to an increase of intestinal material. Altho the intestines do not increase in weight, yet the intestines with their contents decidedly increase in weight due to the greater amount of food eaten.

At the same time the intestines are becoming larger, the ovary and the oviduct are also decidedly increasing in size and weight (figs. 20 and 21). The hen shown in figure 20 had not laid for several months, and the intestines, the ovary, and the oviduct are all very much smaller than those of the hen shown in figure 21, which was laying heavily at the time the photograph was taken.

INDICATIONS OF LAYING

CHANGES IN FAT

As can be seen in figures 20 and 21, the intestines and their contents, the ovary, and the oviduct decrease very decidedly in size and weight after a fowl stops laying, and yet the total weight of the hen, as records show, tends to increase. This is due to the depositing of a layer of fat nearly all over the body just underneath the skin and of a thick mass of fat in the abdomen. A hen is able to deposit this layer of fat only when she is not forming yolks at a rapid rate, since they are composed very largely of fat. In fact during heavy production a fowl draws on the reserve of fat held in the body. Gradually by heavy production, a thick layer of fat, such as is shown in figure 20, is reduced to the condition seen in figure 21.

Pelvic arches. Of course such a change in fat deposition could not occur without its becoming manifest externally. When a hen stops laying, fat is deposited around the pelvic bones (fig. 22), so that they feel blunt and stiff as compared with those of a laying fowl (fig 23). When a hen becomes sick and all the fat in the body is used up (fig. 24), the pelvic bones feel very thin and pliable. Of course the emaciated

condition alone would show that the fowl could not possibly be laying. In a healthy fowl, the apparent thickness of the pelvic bones is a fair indication of production. The thicker the bones (bone and fat), the longer it is since the fowl stopped laying.

Shanks and head. The back of the shanks fill up with fat and become firm and round after a hen has stopped laying for some time (figs. 25 and 26). The face fills out and the back parts of the wattles drop down, giving the face a full, coarse, masculine appearance. If the heads of the fowls shown in Plate III are studied carefully, it will be seen that the face of a non-laying fowl is much fuller, and that the top line of the wattles is more nearly perpendicular to the line of the eye and beak. All these changes in fat deposition, because they are slow, are of value in telling long periods of production or of nonproduction. They are usually not appreciably noticeable for from two weeks to a month or more; so when extreme coarseness is found, it is nearly positive proof that the hen has not been laying for weeks or months.

CHANGES IN COLOR

Fortunately, while it takes several weeks for sufficient fat to accumulate to be apparent, in the yellow-skinned breeds the yellow pigment, or xanthophyll, that accompanies the fat is noticeable when only a small amount of fat is deposited or withdrawn. In such yellow-skinned breeds as Rocks, Reds, Wyandottes, Leghorns, and Brahmas, it is possible to tell by the color of certain sections whether the hen is laying or not. A heavy laying hen is pure or nearly pure red and flesh color in comb, face, beak, and eye ring, while a hen that is not laying is distinctly yellow (Plate II). The rate at which yellow pigment disappears from any section depends mainly on the rapidity or amount of the circulation thru the part affected, the nature of the food supply, and the amount of fat stored within the section. Because of the circulation, the skin just within the edges of the vent is the first to fade or to take on color; then the eye ring, the ear lobes, the beak, and the shanks are affected in the order named.

If the hens are given an abundance of green food or yellow corn, the yellow pigment will color highly any fat that is in the body, so that only a little fat is needed to become apparent. Consequently hens on good grass range do not bleach out nearly so quickly as those that are confined to bare yards and are not given green food.

The heavy breeds, because of their coarseness, carry much larger supplies of fat, and hence do not bleach out so quickly as the light breeds. This difference is especially noticeable in the shanks.

In considering color changes it should be borne in mind that they indicate a withdrawal or an increase of fat, and that they do not indicate

future production. The color and the fat changes show what a fowl has done and not what it will do.

Vent and eye ring. It was first pointed out by the members of the Poultry Department of the Connecticut Agricultural College that the color of the skin just within the edges of the vent changes color very rapidly with egg production. The color of the eye ring (Plates I, II, III), since it also is plentifully supplied with blood, changes very quickly with production. The yellow eye ring denoting a hen that is not laying, is very noticeable. The yellow color comes back in a few days after a hen stops laying, goes out by the time she begins laying, and stays out until she stops for a few days.

Beak and shanks. The beak and the shanks fade out slowly because circulation there is slow, and, conversely, the color comes back slowly. In the beak the color fades out at the base first and then gradually to the tip. Color appears first at the base and gradually extends to the tip. If the whole beak is pale, the hen has been laying for some time; if yellow, she has not laid for some time.

Because the color in the shanks comes and goes slowly, they are very valuable as indicators of long periods of production or nonproduction. The yellow color fades from the sides and the front of the shanks first, and finally from the scales on the rear.

Ear lobes. While all the color characters so far described are applicable to all yellow-skinned breeds, Leghorns and Anconas show a change in the color of their ear lobes, as pointed out by Blakeslee and Warner.[1] The color of the ear lobes (Plates I and II) does not change so quickly as that of the vent or the eye ring and does not have such universal application, but, because of its prominence, it is of considerable value in selecting Leghorns.

Disease. A sick hen loses fat and completely fades out (Plate V). With such a loss there is generally a bluish color in the comb and the shanks, and the plumage is rather likely to be badly soiled.

CHANGES IN BODY SHAPE

Abdomen and pelvic arches. Besides the changes in the shape of the head and the shanks due to fat deposition, there is a decided change in the outline of the body (figs. 27 and 28, and Plates I, II, and V). A hen that is laying has an enlarged abdomen, due to the enlarged intestines, ovary, and oviduct. The body is deeper at the rear than at the front of the keel. This condition is reversed when a hen stops laying. The pelvic bones are well spread. The pelvic arch and the abdomen

[1] Correlation between egg-laying activity and yellow pigment in the domestic fowl. A. F. Blakeslee and D. E. Warner. The American naturalist, 49: 360-368. 1915.

increase in size, depending on how heavily the hen is going to lay. If the hen is going to lay heavily the next week, it has a full abdomen and wide-spread pelvic arch. If it is only going to lay lightly, the abdomen is smaller, due to the less amount of material inside. If it is not going to lay at all in the next week or two, the abdomen and the pelvic arch are very much contracted (figs. 22 and 23). The absolute size of the abdomen and the distance between the pelvic bones depend on the size of the fowl, the size of her egg, and the number of eggs she is going to lay in the next two weeks, while the relative size depends only on the number of eggs she is about to lay.

Fullness of vent. At the same time that the abdomen enlarges, the vent grows larger and flabbier (fig. 23). A heavy laying hen has a full, moist vent, as compared with the small, hard, puckered vent of a non-laying hen.

Texture of skin. The same flabbiness that is noticeable about the vent is true of the skin all over the rest of the body. A laying hen is soft and flabby, and the bones are readily felt; a non-laying hen is hard and plump, and the bones are not evident.

CHANGES IN SECONDARY SEXUAL CHARACTERS

The secondary sexual characters, ear lobes, comb, and wattles, respond directly with the primary sexual character, the ovary. When a fowl is in a heavy laying condition, the ear lobes are large and full (Plates I and III A). As production decreases, the ear lobes contract (Plates II and III B).

With large-combed breeds, such as Minorcas, Campines, Leghorns, and the like, the comb is a remarkable indicator of the laying condition of the fowl. Of course, the same differences are true of the smaller-combed breeds, but are much more difficult to see. The comb expands or contracts, depending on the condition of the ovary. If the hen is prepared to lay very heavily the following week, the comb is very full, smooth, stiff, and shiny. It is so engorged that it feels waxy. As the ovary decreases, the comb loses its stiffness and becomes soft and pliable. Little excrescences begin to stand out, and the comb feels a little rough to the touch. This roughness can be seen on the back part of the comb of the hen shown in Plate V. When the comb is rough, it means that the hen will only lay lightly the following week. If the comb shrinks until it is hard and dry, and is covered with yellowish white scales or dandruff, the ovary is dormant (Plate II). This condition usually occurs during the early part of the molt. It further indicates that the fowl will not lay for several weeks to come. When a hen commences to lay, for instance after being broody, the comb enlarges, breaking up the white scales that have formed, and bright glossy areas can be seen between the white particles (Plate IV). While the comb is enlarging, it feels rather warm,

A TYPICAL NONPRODUCER

This hen began laying March 3, 1917; she stopped June 16, 1917. Her record was 30 eggs. Note the yellow color of the head, the shanks, and the plumage; the hard, dried scale-covered comb; the wrinkled ear lobes; and the full face

A

A. A LAYING HEN

The yellow color is absent, the face is thin; and the ear lobe is full

B

B. A NON-LAYING HEN

The face, the eye ring, and the beak are yellow. The face is full; the ear lobe is wrinkled; and the wattle is low in the rear

FIG. 20. THE INTERNAL ORGANS OF A HEN THAT HAD NOT LAID FOR SEVERAL MONTHS

The intestines are short and small; the ovary and the oviduct are shrunken or dormant; and there is a thick, hard layer of fat in the abdomen

FIG. 21. THE INTERNAL ORGANS OF A HEN THAT WAS LAYING HEAVILY

The intestines are long and full; the oviduct is large and has an egg forming in it; the ovary is full of yolks; and the layer of fat is comparatively thin and soft

FIG. 22. THE SAME HEN SHOWN IN FIGURE 20

The body is full, hard, and plump; the vent is small, hard, and puckered; and the distance between the blunt pelvic arches is short

FIG. 23. THE SAME HEN SHOWN IN FIGURE 21

The skin is soft and flabby; the vent is large, full, and moist; and the pelvic arches are widespread

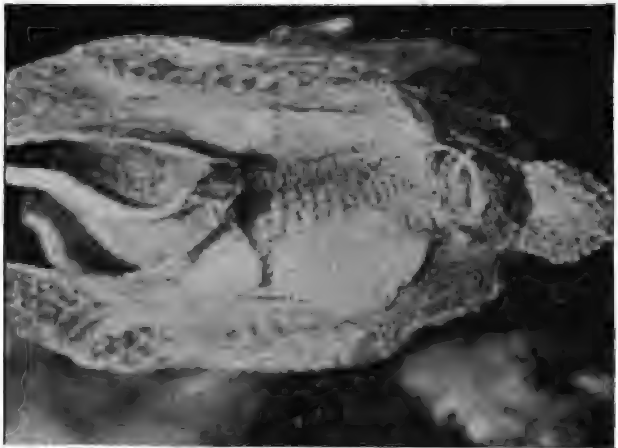

FIG. 24. THE SAME HEN SHOWN IN PLATE V

This hen is in an extremely emaciated condition, and the pelvic arch is narrow. A hen must have a surplus of fat in order to lay

FIG. 25. THE SHANKS OF THE HEN SHOWN IN PLATE II
The shanks are full, hard, and round in the back

FIG. 26. THE SHANKS OF THE HEN SHOWN IN PLATE I
The shanks are thin and soft in the back

FIG. 27. THE SAME HEN SHOWN IN FIGURE 20
The end of the keel bends up into the abdomen, and there is a thick layer of hard fat in the abdomen

FIG. 28. THE SAME HEN SHOWN IN FIGURE 21
The abdomen is deep and full. The bird is deeper behind than in front

A TYPICAL EXPANDING COMB

A hen that will lay soon. The comb is expanding, and the scales are breaking up and dropping off. The comb feels warm to the touch

A SICK HEN

Note the listless attitude, the emaciated condition, and the bluish color of this hen. Such a hen should not be mistaken for a layer because of the pale beak and shanks or because of the ragged plumage

probably due to the increased blood supply. At all other times the comb is comparatively cold.

There is one rather anomalous condition in which the comb would class a hen as laying when the pigment and the fat characters would indicate the contrary. This occurs when a fat hen is reabsorbing her yolks as fast as they are fully formed. The ovary is full, and hence the comb is full; but because the fat is not lost from the body, that is, laid out, the color does not fade. Such a hen is, of course, worse than useless.

CHANGES IN PLUMAGE

As soon as a hen starts molting, she usually stops laying. It is rather rare to find a Leghorn or other light breed that is actively molting and laying at the same time. Some of the heavy breeds molt and lay to some extent at the same time, but as soon as Leghorns start molting, it can usually be taken for granted that they will not lay for two or three months at least. By studying the rate of renewal of feathers, it is quite possible to estimate accurately how long since the hen stopped laying. The body feathers are shed first, then the tail, and then the wings begin to molt from the middle toward the inside and the outside. Because molting is so obvious, it is one of the best characters, if not the best, to be used for culling in the fall. New feathers as they develop on yellow-skinned fowls with white plumage are usually yellow (Plate II) if the fowls are on grass range.

CHANGES IN ACTIONS

While depending largely on color and body changes, one should never lose sight of the difference in the actions of laying and non-laying hens. A laying hen is wide-awake and active. She is continually scratching and digging. She is not listless and dumpish, as is a sick hen (Plate V), nor is she "scary" so that she hangs around the edge of the flock at feeding time, as does the non-laying hen. She wants to be friendly, and by her continual singing asks to be saved and appreciated.

SELECTION

As soon as it is possible to tell the laying hens from the non-laying and to tell which hens have not laid for some time, it is a comparatively easy matter to separate the high producers from the low producers.

PERSISTENCE IN LAYING

A study of trap-nest records show that the longer the period over which a hen lays, the greater is her production; that is, a hen that lays steadily for twelve months makes a high record, while a hen that only lays for four months, has not the time in which to make a good record.

The difference in the length of laying period and the records of the fowls shown in Plates I and II should be noted. Pullets that begin to lay early in October, November, or December, and lay until the following September, October, or November, make high records. If they do not begin until February or March, there is not time enough to make a high record that year. If a pullet begins laying early and quits early, she makes about as good a record as a fowl that begins late and lays late; but the records at this College tend to show that the early quitter is not so valuable as a breeder as the late beginner. A hen that begins laying late in the spring and quits early in the summer is a poor hen. The quitters should not be kept, and only the persistent layers should be used for breeding.

AGE

A hen does not need to be culled on account of her age. If a hen lays well one year, she should be kept for another as a breeder. The older she is and the more culling she survives, the better, for then she has proved that she has the vitality to stand up under long-continued laying, and hence is many times more valuable as a breeder than is a pullet or a yearling hen. A flock of persistent layers should be kept each year for breeding; the older they are, the better.

TIME OF CULLING

Culling should begin in June or July, just as soon as any of the hens stop laying, and should continue in the fall until the flock is reduced enough to make room for the well-developed pullets. Under most conditions, it is preferable to carry over one-half or two-thirds of the hens rather than to raise pullets to take their places. By beginning culling early in summer, a big saving can be made in feed, and the culls will usually bring more than they will late in the season. Occasionally, a fowl that stops laying in June or July will molt and start laying again in October or November. This is the exception, however. Nearly always the fowls that stop laying early do not begin again until after the fowls that laid late. The late layers molt quickly, while the early quitters molt slowly. If only one culling is made, it can generally be done best in the early part of September, and at that time all hens that have quit laying should be culled.

METHOD OF CULLING

The best method for culling depends on the condition of the fowls and on the method of housing. If the fowls are tame, it is comparatively easy in a small flock to pick up the hens that have stopped laying without disturbing the remainder of the flock. If nearly all the fowls are molting,

so that they are very sensitive, it is probably best to go over the flock while on the roosts at night, and pick out the hens with hard, dried combs, and that have hard abdomens, and are molting. These hens should be gone over in the daytime, in order to make sure that the selection is correct.

In the case of large flocks or flocks that cannot be handled at night, it is best to drive the hens into catching crates by means of wire alleyways. Care must be taken not to frighten them. When flocks are properly culled, the hens that are left generally lay more after the poor ones are taken out, because they then have more room and better conditions.

OTHER PUBLICATIONS ON POULTRY HUSBANDRY

The following publications will be sent free to residents of New York State on request. Address the Office of Publication, New York State College of Agriculture, Ithaca, New York.

A continued study of constitutional vigor in poultry. Cornell University Agricultural Experiment Station. Bulletin 345.

The interior quality of market eggs. Cornell University Agricultural Experiment Station. Bulletin 353.

Poultry parasites: some of the external parasites that infest domestic fowls, with suggestions for their control. Cornell University Agricultural Experiment Station. Circular 29.

Incubation. Cornell Reading Course for the Farm. Lesson 80.

Feeding young chickens. Cornell Reading Course for the Farm. Lesson 88.

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A. R. Mann, Director of Extension Service

Construction and Management of Root Storage Cellars

James L. Strahan

A good type of entrance for a root cellar

Published and distributed in furtherance of the purposes provided for in the Act of Congress of May 8, 1914

CONSTRUCTION AND MANAGEMENT OF ROOT STORAGE CELLARS

James L. Strahan

In order to keep efficiently the various kinds of root crops until they are needed for human consumption or as a succulent food for the dairy herd during the winter, it is sometimes necessary to store them in well-constructed underground bins or cellars, where they can be protected from freezing temperatures and at the same time be easily accessible. It was formerly a custom among farmers, and the practice is still prevalent to a certain extent, to bury roots in shallow pits, covering them with straw and earth to prevent them from freezing. With care, large crops can be wintered over in this way; but for greater convenience in handling, both at time of harvesting and at periods when roots are to be used, storage cellars are decidedly more economical.

ESSENTIALS OF A GOOD ROOT CELLAR

SITE

It is well to have the cellar located in a sheltered place where the prevailing winter winds cannot blow on the exposed parts. In New York State this location is probably best found in a hill having a southeastern exposure. If the cellar is not entirely underground, the least surface will be exposed by placing it with the long dimension northwest and southeast. In the case of the completely buried house it is essential that the entrance door should face south if possible, the direction of the long dimension being here of small consequence.

INSULATION

The best and cheapest insulation for the root cellar is plenty of earth piled on top and banked against the sides. It is always desirable to have at least two feet of earth on top of the cellar. However it is often the case that, by reason of the topography of the site, the roof and a foot or so of the side walls are exposed. If these exposed surfaces are of concrete construction of 8 inches or more in thickness or stone walls 18 inches thick, there is little likelihood of frost penetrating in amounts that are disastrous. Such cellars are never so efficient as those completely buried, and in times of extreme cold weather it will be found necessary to provide artificial heat. If the roof is of wood and exposed, insulation may be obtained by roughly ceiling the cellar inside at a level with the eaves and packing the space between the ceiling and the rafters with straw,

hay, leaves, or similar material. The point to be particularly protected in this case is where the roof joins the walls. Unless this space is well packed, frost is sure to enter, as it is the point of least thickness between the cellar and the outside air. Old carpet, burlap, or other material of the same nature will answer very well for packing this corner.

VENTILATION

In order to control the humidity and to aid in regulating the temperature, a system of ventilation is essential. In the cellars that are completely buried, ventilation is provided thru openings in the roof by means of clay tiles or wooden flues, the tops of which are capped with wooden or galvanized iron ventilator heads of such type as will deflect rain water and keep the drip out of the cellar. In the coldest weather, excessive air movement is prevented by some sort of checking device in order to maintain the temperature above freezing. It has been found in actual experience that when the cellar is not over 8 feet high, this flue area should be from 45 to 80 square inches for every 1000 cubic feet of storage space, depending on the size of the cellar. It must be understood that this amount of ventilation is vastly in excess of what is required during very cold weather, and means must be provided whereby it can be reduced. It is much better, however, to have too much than too little ventilation, as the former condition can easily be remedied, whereas the latter cannot.

It is well to provide fresh air intake ducts to insure a good ventilation of air thru the mass of roots placed in storage. These ducts should be installed near the floor of the cellar. Often the drain that carries off water from the cellar is utilized as an air duct.

In order to insure an adequate circulation of air inside the cellar, the roots should be stored in bins having slatted partitions. The partitions are constructed of 2x4-inch studs set up flatwise to the bin and sided on both faces with 2-inch furring strips nailed with 1½-inch spaces between. Partitions so constructed allow a 2-inch air space between each pile of roots and will provide adequate ventilation. Slatted sections should be laid on the floor and the roots piled on them, thus allowing circulation of air under the piles. Ordinarily roots should not be piled deeper than 5 feet, altho, if ample facilities exist for going over the crop, they may be piled 6 to 7 feet deep in the bins.

OPENINGS

Doors and windows are points where most frost is likely to enter unless precautions are taken. Doors should be double in all cases, and windows should be tightly constructed, either double, if light is desired in the cellar

in cold weather, or, if this is not considered important, in such a manner as to make it convenient to bank them up with manure or straw on the outside.

DRAINAGE

The grading around completely or partly buried cellars should be such as to deflect all surface water from the walls. Tile should be laid around the bottom of the wall on the outside to carry off excess water. A drain should also be provided in the floor of the cellar. When the floor is of earth, the inside entrance to this drain can be located in the south wall at a level with the floor. It must be screened to prevent

FIG. 29. A MONOLITHIC CONCRETE CELLAR WITH SOUTHERN FACE EXPOSED

trash and mud from entering and clogging the pipe and to prevent small animals from entering the cellar.

EXAMPLES OF SUCCESSFUL ROOT CELLARS

CONCRETE CELLAR WITH COVERED ROOF

The cellar shown in figure 29 is built of concrete and is completely covered with earth except on the exposed southern wall. It is 30 feet x 30 feet inside measurements, and has about 7½ feet headroom. It is divided into three compartments, each 10 feet x 30 feet, and each compartment is provided with ventilation at the rate of 70 square inches outtake flue area per 1000 cubic feet available storage space. The ventilation flues

consist of 16-inch sewer pipes extending from the concrete roof up thru two or two and a half feet of earth, and capped with galvanized iron ventilator hoods. These are located in the rear of each compartment and do not appear in the illustration, being hidden by the front edge of the roof. During the winter they are choked down by stuffing them with burlap. Intake ventilators are provided for the two end compartments and appear as round holes in the wall near the ground. They consist of 12-inch drain tile laid in the wall and are well screened on the inside. The floor is of concrete.

FIG. 30. A MONOLITHIC CONCRETE CELLAR COMPLETELY INSULATED BY EARTH
Note construction of window and screening

This cellar has given very good satisfaction, and only occasionally, when the temperature dropped very low, was it necessary to hang a lantern near the door to maintain the required amount of heat.

A small monolithic concrete cellar with 8-inch walls and 8-inch reenforced roof completely covered with earth on the sides and the top to an average depth of 2½ feet, is shown in figure 30. The south wall, shown in the illustration, is insulated by 18 inches of earth held in place by a rough wooden wall. The window is left open except during cold weather, when it is stuffed with leaves and straw and boarded over. The entrance is of an especially good design, consisting of a small areaway

covered by two doors similar to those generally used for a common house cellar entrance. Another door is hung vertically in the main entrance to the cellar, and the two together insulate the interior very satisfactorily in the coldest weather.

Ventilation was originally provided at the rate of 42 square inches per 1000 cubic feet capacity, but after one winter's use this was found to be inadequate and increased to 90 square inches by cutting an opening 8 x 8 inches in the roof. A 4-inch drain leading from the bottom of the inside face of the south wall to a point 25 or 30 feet from the cellar, acts as an intake ventilator as well as a drain. It is well screened on the inside to prevent the entrance of small animals.

FIG. 31. A TYPE OF CELLAR ONLY PARTLY BURIED

Since the increase in the amount of ventilation, this cellar has given exceptionally good service. At the time the photograph was taken, June 30, 1917, the writer was given a Winter Banana apple, which had been stored here all winter and had not yet started to shrivel. It appeared to be in as perfect condition as the day it was put in storage.

CELLAR WITH EXPOSED ROOF

A type of cellar only partly buried is illustrated in figure 31. The construction in this case consists of a 2-foot dry stone wall pointed up on the outside and roofed over with a common frame roof. Insulation against entrance of heat in warm weather or loss of heat in cold weather is obtained by roughly ceiling over the inside at a level with the eaves and completely filling the space between the ceiling and the rafters with

straw and leaves. In this instance old carpet was stuffed tightly between the plate and the rafters, the owner declaring that this material resists rotting much longer than the more commonly used burlap.

Both cellars are 22 x 80 feet. The cellar on the right is provided with ventilation at the rate of 105 square inches of outtake flue area per 1000 cubic feet of storage space, thru six wooden ventilator flues each 12 x 18 inches inside. The cellar on the left has three ventilator flues each 12 x 18 inches, and therefore has only one-half the amount of ventilation that

FIG. 32. A PARTLY BURIED CELLAR
The small amount of ventilation here shown makes this cellar inefficient

the other has, or 53 square inches. The practice on the cellar provided with six ventilators, is to keep three of them stuffed up all the time, as the remaining three have been found ample for the work. It would seem therefore that 50 square inches of flue area for a cellar of this size is better than 100 square inches. These cellars are both giving satisfactory service and have been for the past six years.

A similarly constructed cellar is shown in figure 32, but differs from those shown in figure 31 in that it is not ceiled over inside and is therefore not properly insulated. Further, it is provided with ventilation at the rate of but about 10 square inches of flue area per 1000 cubic

feet capacity. The result is a very inefficient storage room that has never given satisfactory results since its construction. However, with the addition of proper roof insulation and from four to five times the amount of ventilation, it could be made a good cellar.

RULES FOR THE CONSTRUCTION OF A ROOT CELLAR

1. A root cellar should be located when possible in a sidehill facing the south or the southeast.

2. It should be completely covered with at least two feet of earth. When this is impossible by reason of the topography, the roof should be thoroly insulated, special attention being given to the point where the roof joins the wall.

3. It should be provided with ventilation approximately as follows:

   For cellars of from 1000 to 5000 cubic feet capacity at the rate of 60 to 80 square inches of flue area per 1000 cubic feet capacity.

   For larger cellars, from 5000 cubic feet up, at the rate of from 45 to 60 square inches of flue area per 1000 cubic feet capacity.

   Intake ventilators should be provided of approximately the same area as the outtake flues. The inside ends of these should be located near or at the floor. The drain may be utilized as an intake ventilator.

4. Drainage should be provided by ordinary vitrified sewer pipe not smaller than 4 inches in diameter, and if intended for use as a ventilator not less than 6 inches. It must be thoroly screened at both ends.

5. Doors should in all cases be double. Windows should be constructed in such a way as to make possible thoro insulation in cold weather by banking them with straw or other similar material. They should be well screened (fig. 30).

6. A dirt floor seems to be preferable to a concrete floor where good solid footing can be obtained. A concrete floor is preferable where it is necessary to exclude ground water due to local springs that cannot be diverted thru drains.

SUGGESTED DESIGNS

CONCRETE CELLAR WITH COVERED ROOF

A design adapted to sidehill construction where it is possible to completely bury the cellar, thus obtaining the most efficient insulation against frost, is given in figure 33.

The walls are of monolithic concrete, 10 inches thick, mixed in the proportion of 1 part cement, 3 parts sand, and 6 parts gravel or broken stone. If good clean bank gravel is available, it may be used in the pro-

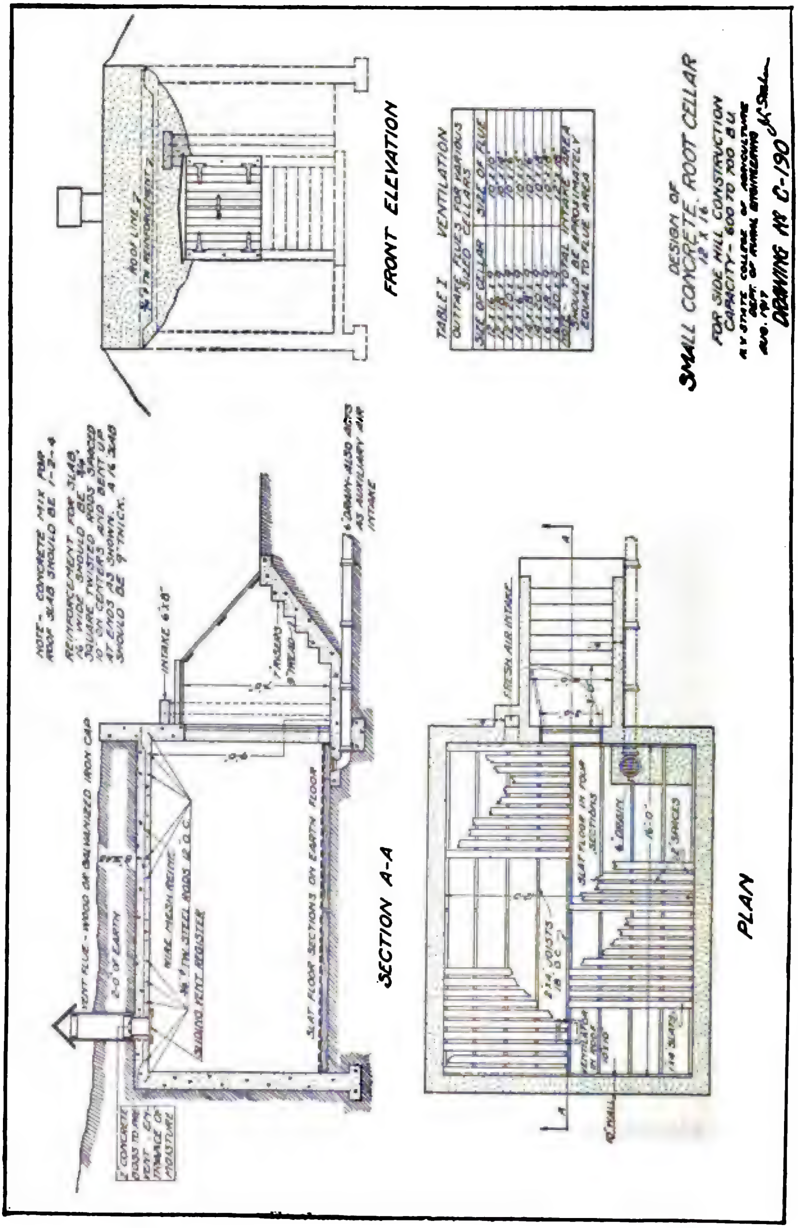

FIG. 33. A CELLAR SUITABLE FOR STORING SMALL AMOUNTS OF ROOTS OR FRUIT

portion of 1 part cement to 5 parts gravel. The footing under the wall should be at least 18 inches wide and not less than 8 inches thick.

The roof is a monolithic concrete slab 8 inches thick, reenforced every 12 inches with $\frac{3}{4}$-inch square twisted steel rods bent up at the ends as shown in the drawings. The slab is reenforced longitudinally by heavy wire mesh fencing or C. S. C.[1] no. 7 triangle mesh located just above the rod reenforcement. The concrete for the slab should be made from screened sand and gravel or crushed stone in the proportion of 1 part cement, 2 parts sand, and 4 parts gravel or stone. It is specifically recom-

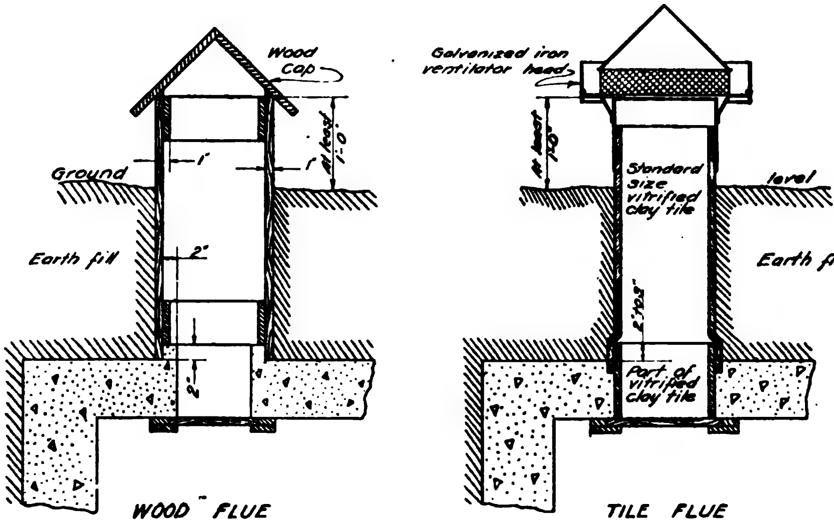

FIG. 34. TWO POSSIBLE METHODS OF CONSTRUCTING THE OUTTAKE VENTILATOR FLUE IN A CONCRETE SLAB ROOF

mended that screened material rather than bank run gravel be used in the roof slab, and that the forms be left in place for at least two weeks, to prevent any possibility of cracking.

In order to prevent soil drainage water from entering the cellar thru the ventilator flue, a 2-inch concrete boss is cast in the roof slab around the vent opening. Possible types of flue construction are shown in figure 34.

The entrance is protected against frost by two doors, one at the top of the steps similar to an ordinary house cellar door, and one at the main entrance. This latter door swings outward in order to obtain the maximum storage capacity of the cellar.

[1] Carnegie Steel Company.

Special provision is made to insure an ample supply of fresh air during the period of the season when it is most needed. A 10x10-inch ventilator flue is built in the roof and extends at least one foot above the ground level over the cellar. The flue may be of wood as shown, or it may be a length or two of bell and spigot vitrified clay tile of equal sectional area. The tile will undoubtedly be more durable than the wood. Care must be taken to make it water-tight (fig. 34).

TILE OF EQUIVALENT SECTIONAL AREA TO VARIOUS-SIZED RECTANGULAR FLUES

Size of flue (inches)	Tile diameter (inches)
10 x 10	12
10 x 14	14
10 x 15	14
10 x 16	15
10 x 18	16
12 x 18	18

An intake ventilator is constructed of concrete and conducts air from a point near the top of the outside door to a point inside the cellar at the floor. Air entering this intake flue must pass under the roots thru the air space provided by the sectional slat floor and thence thru the mass of the roots to the ventilator in the roof. A 6-inch tile drain is provided which will also act as an auxiliary air intake.

Cellars of this type can be constructed economically up to a size of 16 x 20 feet or perhaps even larger. Above these sizes, however, the relative cost of construction between this type and the type shown in figure 35 makes the latter preferable for average conditions where large amounts of roots are to be stored.

The bill of materials for the small monolithic root cellar shown in figure 33 is as follows:

CONCRETE

Cement	130 bags
Sand	14 yards
Gravel	28 yards

REENFORCEMENT

18 ⅜-inch square twisted steel rods 14 feet long

64 feet no. 7 (C. S. C.) triangle mesh reenforcement 38 inches wide or equivalent amount of heavy wire fencing

LUMBER

Form sheathing.....	1,000 board feet 1x6-inch unmatched boards
Form studs.........	21 pieces 2x4-inch hemlock or other cheap material 10 feet long
Slats...............	400 linear feet 1x4-inch strips
Doorframe..........	1 piece 2x10-inch lumber 14 feet long 1 piece 2x10-inch lumber 4 feet long

Doors and ventilator may be made from the form lumber after it is removed. This lumber may also be utilized as supports and shoring for the roof slab.

CELLAR WITH EXPOSED ROOF

A type of cellar that is adapted to level ground construction or sidehill construction where it is not convenient to cover the roof with earth, is illustrated in figure 35.

The walls are of concrete 12 inches thick, or they may be made of field stone laid 24 inches thick. The general specifications for the wall and the footing in figure 33 should apply here also. If the cellar is built on level ground, it probably will be sunk in an excavation 4 or 5 feet deep and in this case will require an entrance similar to those shown in figures 30 and 33. If built in a bank where the entrance can be on a grade with the floor of the cellar, it may be similar to that shown in figure 31. In either case the door should be double for protection against frost.

The interior is arranged in a double row of bins each 8 x 8 feet with a 4-foot alley thru the middle. At the alley corner of each bin is a 6x6-inch post built up of 3 pieces of 2x6-inch material. The center piece is cut 6 inches short to allow for a 2x6-inch stringer, or ceiling support, which runs longitudinally thru the cellar along the top of the posts. On this 2x6-inch piece rest 2x4-inch joists spaced 2 feet and 6 inches on centers, and these in turn support a ceiling of 1-inch unmatched boards. A 4-inch shoulder, 10 inches from the top, is constructed on the inside of the long walls to receive the ends of the 2x4-inch joists, as illustrated in the detail at eaves (fig. 35). This allows a space of about 15 inches between the ceiling and the roof at the point where the roof joins the wall, which can be stuffed with old rags, carpet, or burlap as an added protection against frost.

Ventilation inside the cellar is provided by means of a raised slatted floor and slatted bin divisions. The details of these partitions are shown

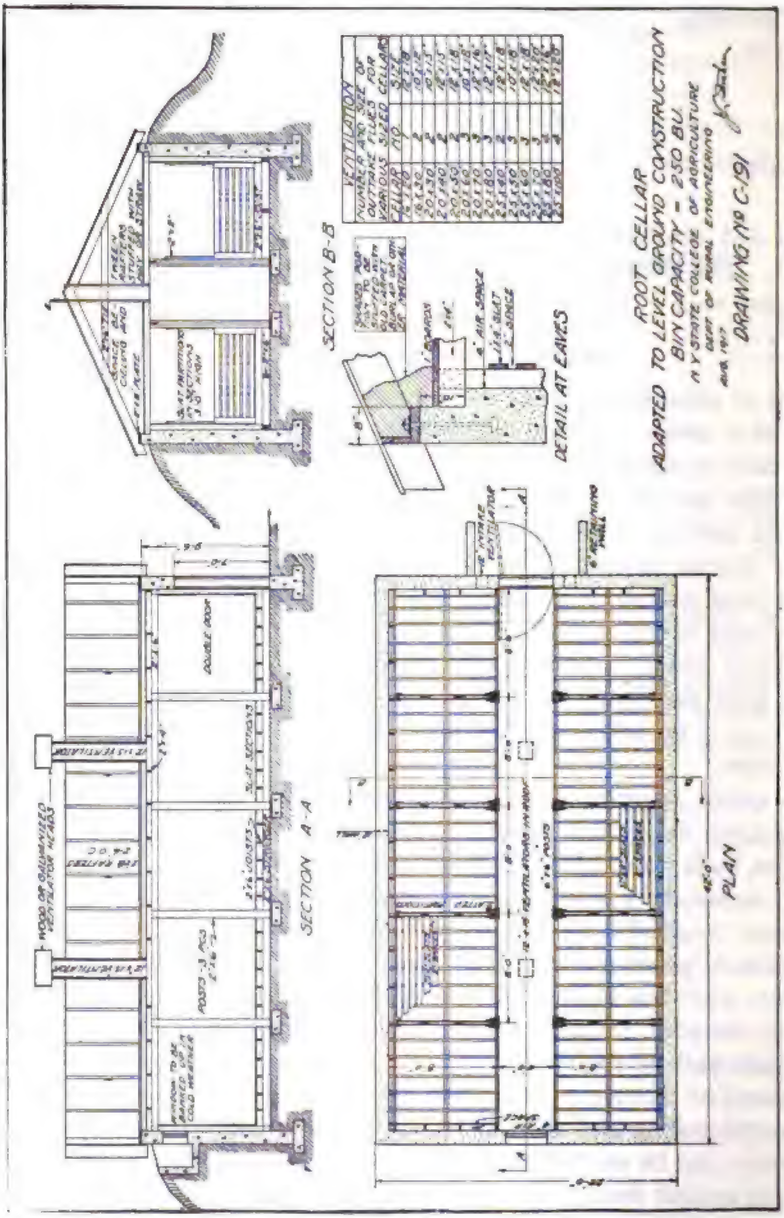

FIG. 35. A PARTLY BURIED CELLAR

This cellar is suitable for the storage of roots in amounts larger than can be economically stored in a monolithic concrete cellar of the type shown in figure 33

in figure 36. Two 12x15-inch ventilator flues are provided extending at least a foot above the peak of the roof. Either hinged or sliding dampers should be used in connection with the ventilators.

The roof is a common frame structure, being supported by 2x8-inch rafters spaced 2 feet and 6 inches on centers. One-inch roof boards covered with a good grade of tarred roofing will be adequate. The space between the rafters and ceiling should be kept packed with hay or straw in the winter for insulation.

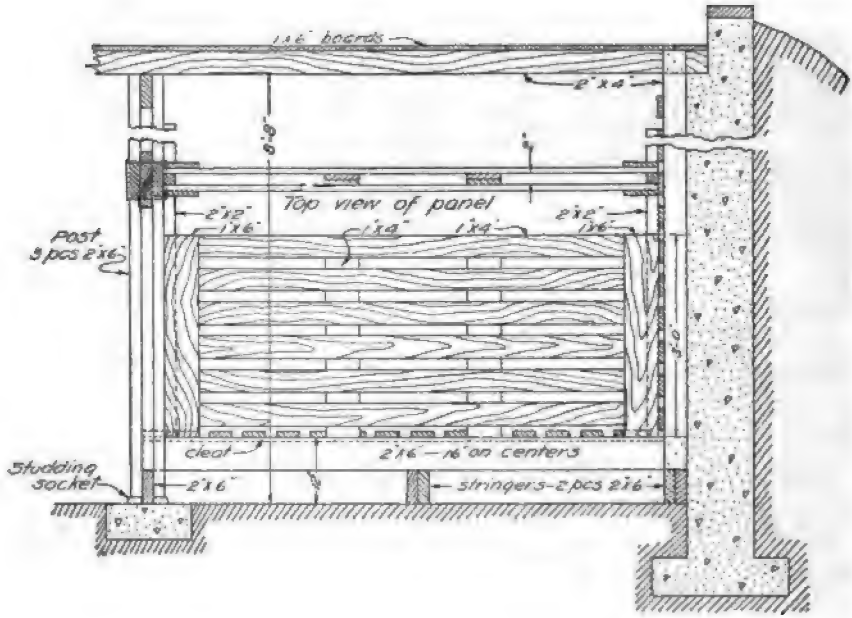

FIG. 36. DETAIL OF BIN PARTITIONS
The panels are made in sections three feet high

The bill of materials for this root cellar is as follows:

CONCRETE

Cement	212 bags
Sand	22 yards
Gravel	44 yards

LUMBER

Floor stringers	20 pieces 2x6-inch lumber 16 feet long
Floor joists	31 pieces 2x6-inch lumber 16 feet long
Floor slats	1,120 linear feet 1x4-inch strips

Wall studs	22	pieces 2x4-inch lumber 18 feet long
Wall slats	1,664	linear feet 1x4-inch lumber
Bin partitions	2,694	linear feet 1x4-inch lumber
Posts	8	6x6-inch studding sockets
	12	pieces 2x6-inch lumber 18 feet long
Stringers	5	pieces 2x6-inch lumber 16 feet long
Ceiling joists	17	pieces 2x4-inch lumber 14 feet long
Ceiling boards	950	board feet 1x6-inch unmatched boards
Plate	2	pieces 2x12-inch lumber 10 feet long
	2	pieces 2x12-inch lumber 12 feet long
	4	pieces 2x8-inch lumber 16 feet long
	2	pieces 2x8-inch lumber 10 feet long
	14	$\frac{5}{8}$x18-inch carriage bolts
Rafters	36	pieces 2x8-inch lumber 14 feet long
Ties	5	pieces 2x6-inch lumber 12 feet long
Roofers	1,150	board feet 1x6-inch rough unmatched sheathing
Roofing	12	squares 3-ply tarred roofing
Ventilators	4	pieces 1x12-inch lumber 14 feet long
	8	pieces 1x8-inch lumber 14 feet long
	2	caps, wood or galvanized iron
Doors		
Frame	1	piece 2x12-inch lumber 14 feet long
	1	piece 2x12-inch lumber 4 feet long
Doors	60	board feet 1x6-inch roofers matched
Nails	60	pounds tenpenny
	50	pounds twentypenny
Other hardware		Hinges for doors, iron strap, and lock

Lumber used for inside work, ceiling, and roof may first be used as forms for the cement work without seriously damaging it.

AN ARCHED-ROOF MONOLITHIC CELLAR

A type of monolithic cellar that requires no reenforcement is illustrated in figure 37. It has an arched concrete roof on concrete side walls and has a concrete floor. Detailed specifications for this type of cellar may be procured from the Farm Bureau of the Portland Cement Association, 111 West Washington Street, Chicago, Illinois.

PIT STORAGE

By careful planning, roots may be stored successfully in pits in large quantities. The common practice is to dig long trenches 12 to 24 inches

deep. After roots are piled in the trenches, ridge fashion, as high as they will stand, a 6-inch layer of straw and enough soil to prevent freezing are added. Small portions of the roots are made accessible during the winter by placing them in sections, separated one from another by straw and earth. In this way one lot or kind of crop can be removed in freezing weather without subjecting the adjacent lots to low temperatures. Each section of the trench is provided with some means of ventilation, usually thru the covering. Drainage is provided by locating the pit on a slight elevation and by digging a shallow ditch above it after crops are placed

FIG. 37. AN ARCHED-ROOF CELLAR
This type of construction requires no reenforcement

in and covered. Potatoes, beets, carrots, and turnips will keep well under these conditions. Apples may be kept also in this way, but the fruit often absorbs a distinctive flavor from the straw and soil used as a covering. Cabbage stored in pits or trenches usually requires a large amount of trimming from spoilage when taken out of storage, especially if water is allowed to drain into the trenches.

MANAGEMENT OF THE ROOT CELLAR [2]

Experience has proved that certain requirements must be met in order to store roots or tuber crops thru the winter successfully. With the

[2] The material on this subject has been furnished by the Department of Vegetable Gardening.

exception of sweet potatoes, a tuber crop, and onions, a bulb crop, these requirements are practically the same.

TEMPERATURE

A temperature sufficiently low to prevent the growth of bacteria or rot fungi, and yet not low enough to cause injury by freezing, should be maintained in storage cellars. Temperatures for carrots, turnips, radishes, and celeriac should not be allowed to go below 33° F., while beets and kohl-rabi may be held as low as 31° or 32° without danger of freezing. Salsify and parsnips are not injured by freezing and need not be kept above 32°. A common practice is to leave these crops in the field where they have grown until wanted for use or market, altho this practice is inconvenient if the roots are desired during the winter months. Potatoes for home use or market purposes need not be held below 36° except where powdery dry rot infection is likely to occur. During the earlier part of the storage season, a temperature of 40° is claimed to be as satisfactory. For seed purposes it may be advisable to hold the tubers at or slightly above 32°. Where several kinds of crops are stored in the same cellar, an average temperature of 33° to 36° gives best results.

Sweet potatoes demand a temperature of 55° with a relatively dry atmosphere. The conditions that cannot be furnished in a storage cellar are best provided in a warm attic or in an especially built storage house. Onions may be stored successfully in a cool dry attic or storage house.

The temperature in the cellar is regulated in the early fall, or just after the roots are stored, by leaving the doors and the ventilators open at night and closing them in the daytime. Later in the season, as the temperature outside falls, the doors are kept closed at night as well as in the day, thereby retaining the heat given off by the roots. By a careful system of operation of doors and ventilators, the temperature can be kept surprisingly constant; but when the outside temperature drops very low in midwinter, it may be necessary for short periods to supply artificial heat. Some persons have found it sufficient to merely hang a lighted kerosene lantern in the cellar at night near the door or at the place where the frost is most likely to come thru. A small coal stove that may be run very low during the coldest nights has also been recommended. In most parts of New York State, however, very little artificial heat is required in a cellar that is properly built and carefully managed.

HUMIDITY

The relative humidity should be such that serious evaporation causing a shriveled appearance and an appreciable loss of moisture from the roots will not occur. However, excessive dampness especially in

the warmer periods of the storage season is favorable to the growth of fungous and bacterial rot organisms.

In storing turnips, carrots, celeriac, and potatoes, the humidity should never be allowed to become so high as to show moisture on the roots. Beets and kohl-rabi will stand slightly higher humidity, and salsify and parsnips will not be hurt by relatively high moisture content in the air.

If several crops are stored in the cellar at the same time, those that will be injured by a high humidity should be in raised bins where they will get the maximum benefit from ventilation. Other crops can be stored on the floor. In general, the crops that require lower humidity need the higher temperatures, and these conditions exist in the raised bins. Crops that do not require the higher temperature usually are not particularly injured by dampness and can be stored on or near the floor very satisfactorily.

The maintenance of constant and exact temperature and humidity relations in a room without artificial heat or draft is a physical impossibility. Therefore good results from the best and most scientifically constructed root cellar can be obtained only at the cost of constant watchfulness on the part of the operator. A thermometer should hang in a conspicuous place in the cellar and should be carefully watched to give warning as to when it is necessary to provide artificial heat. Seldom will this be needed in larger amounts than can be obtained from a lighted lantern, but this small amount may mean the difference between success and failure, between a crop of potatoes well wintered or a pile of frozen roots unfit for any use whatever.

LIGHT

Natural light is excluded from stored crops, especially from potatoes. Tubers exposed to a modified light only are injured for food purposes. For seed purposes, potatoes exposed to the light for several weeks previous to planting have been found desirable from the standpoint of earliness and vigor in the crop the following season. Exposing seed potatoes in this way is known as sun-sprouting. They are usually placed in a single layer near a window thru which the rays of the sun strike as directly as possible.

Better results will be obtained if crops to be stored are harvested when properly matured. Overmature roots become tough and fibrous if stored for any length of time, especially if temperatures are not held constant. On the other hand, vegetables that are only one-half or two-thirds grown wilt and shrivel unless covered with moist sand. Parsnips and salsify are usually packed in moist sand even tho they may be properly matured; otherwise they wilt badly. Winter radishes packed in moist sand may be kept until Christmas.

Experience has proved that all crops must be carefully handled in preparation for storage. Bruised or injured specimens soon decay and thus cause others resting against them to decay. If potatoes cut in digging or bruised in shoveling are picked out, loss from spoilage will be kept at a minimum.

Root crops should not be topped too closely. One or two inches of leaf stems left attached to roots protect the tops, thereby reducing excessive transpiration and bleeding. Crops should not be stored earlier than necessary in the season.

STORAGE OF APPLES [3]

Altho there has been great commercial development in the cold storage of apples, comparatively little careful scientific work has been conducted along this line. Consequently there is little real knowledge as to exact temperatures that are most desirable, also as to the moisture content of the air that will give best results.

TEMPERATURE

It is generally considered best to maintain a temperature as near the freezing point as possible. The temperature of 31° F. will not freeze apples and will probably give a longer keeping season than may be obtained at a higher degree. The lowest temperature that may be maintained without freezing will also be beneficial in retarding development of fungous diseases. It is very important that the temperature be as uniform as possible.

MOISTURE

As before stated, there is no definite information as to the best degree of moisture for holding fruit. It is a well-established fact, however, that there should be sufficient humidity to keep fruit from shriveling. In some of the general commercial cold storage plants, apples are stored in the dampest rooms. It is suggested that the highest degree of humidity that will not induce the growth of mold or mildew on barrels or other containers be maintained.

CONDITION OF THE FRUIT

If apples are to keep for a long period, they should be well matured, that is, hard ripe, at the time of storing. Well-developed fruit is always less subject to storage scald than fruit that has not yet reached its maximum color. However, storage scald is somewhat a variety characteristic. For long storage, fruit must be in good physical condition, that is, free from bruises, and also free from skin punctures of any kind.

[3] The material on this subject has been furnished by the Department of Pomology.

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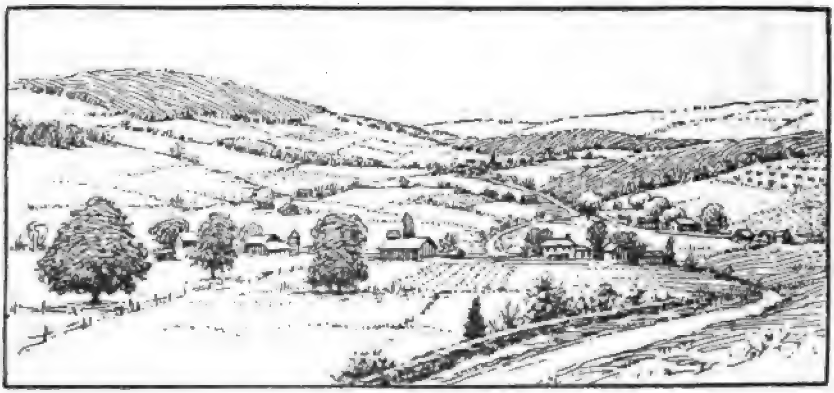
Suggestions to Purchasers of Farm Lands in New York

Elmer O. Fippin



A typical view of the hill land of southern New York

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Act of Congress of May 8, 1914

SUGGESTIONS TO PURCHASERS OF FARM LANDS IN NEW YORK

ELMER O. FIPPIN

The extensive advertising of cheap lands in New York, particularly by farm real estate companies, has drawn the attention of many persons in cities and of farmers in the middle and western States. Many farms have been purchased by these classes of people, and many more persons are making inquiry about the character and value of the lands offered for sale at what often seem to be very low prices.

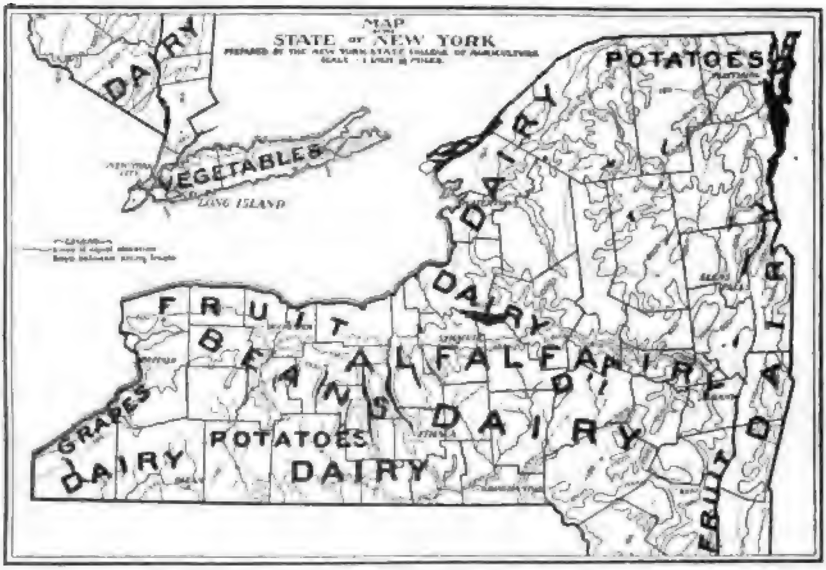

FIG. 38. OUTLINE MAP OF NEW YORK, SHOWING THE DISTRIBUTION OF DOMINANT AGRICULTURAL INDUSTRIES

Taking all classes of farm land in New York as compared with all classes of farm land in the middle and western States, there is little doubt that the New York land is relatively lower in price; but the difference is not so great as some statements would suggest. There is often an inclination to compare the price of the poorer lands in New York with that of the better lands of the other regions.

The increased interest in farm land in New York and other eastern States seems to be merited. New York has much land of a highly productive character situated within reach of reasonably good to excellent transportation facilities. Upwards of one hundred million dollars have

been spent in improving the main wagon roads under a state, county, and town system of highways. Finally, the State is at the center of a district having the largest aggregate population of any similar area in the western hemisphere. With Syracuse as a center, there is in a district with a radius of four hundred miles an urban population of twenty-five million and a total population of forty million, which is a third of the total on the North American continent.

The purpose of this bulletin is to put prospective purchasers of farm land on their guard, to lead them to scrutinize very carefully the descriptions of lands that are presented to them by commercial concerns,

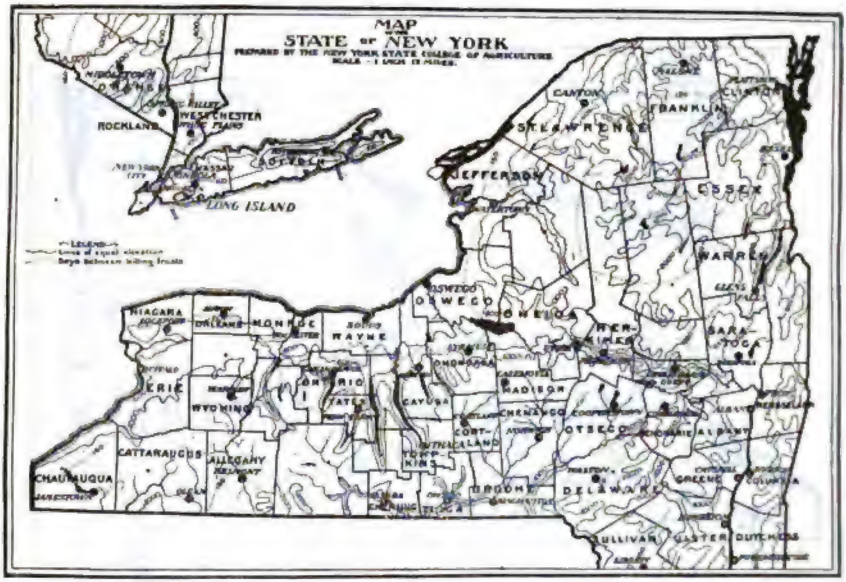

FIG. 39. MAP SHOWING THE LOCATION OF FARM BUREAU OFFICES IN THE COUNTIES
The black circles mark counties in which farm bureaus have been organized

to make inquiry in disinterested quarters concerning the land and the agricultural conditions in the region in question, and to point out some of the vital distinctions between the better and the poorer lands of the State that may be offered for sale.

SOURCES OF INFORMATION

New York State has an extreme variety of soils and of conditions for agricultural development. In order to find the profitable farm situations that are available, it is wise to make a careful personal study of conditions and to utilize the public agencies available for supplying information covering the conditions and the possibilities in the several counties of the State. Besides the state institutions — the State College of

Agriculture at Ithaca, the State Experiment Station at Geneva, and the State Department of Agriculture at Albany — there are farm bureau agents in forty-two counties (fig. 39). These men are acquainted with local conditions in their territories and can also put prospective purchasers in touch with reliable local farmers who can give dependable information about the value and the possibilities of land in that region. The following is a list of counties having farm bureau offices with their addresses:

County		County	
Albany	Albany	Niagara	Lockport
Allegany	Belmont	Oneida	Utica
Broome	Binghamton	Onondaga	Syracuse
Cattaraugus	Olean	Orange	Middletown
Cayuga	Auburn	Orleans	Albion
Chautauqua	Jamestown	Oswego	Oswego
Chemung	Elmira	Otsego	Cooperstown
Chenango	Norwich	Rensselaer	Troy
Clinton	Plattsburg	Rockland	Spring Valley
Cortland	Cortland	St. Lawrence	Canton
Delaware	Walton	Saratoga	Saratoga Springs
Dutchess	Poughkeepsie	Schoharie	Cobleskill
Erie	Buffalo	Suffolk	Riverhead
Essex	Essex	Sullivan	Liberty
Franklin	Malone	Tioga	Owego
Herkimer	Herkimer	Tompkins	Ithaca
Jefferson	Watertown	Ulster	Kingston
Madison	Cazenovia	Warren	Warrensburg
Monroe	Rochester	Wayne	Sodus
Montgomery	Canajoharie	Westchester	White Plains
Nassau	Mineola	Wyoming	Warsaw

A further source of information is the soil survey reports and maps descriptive of single counties. The maps show the distribution of the different kinds of soil, and the text describes their character and relation to crops, together with the general agricultural conditions in the region. A key to the areas that have been surveyed, with an indication of the availability of the reports, is given in figure 40. They are prepared by the United States Bureau of Soils and the State College of Agriculture working in cooperation, and the later reports are distributed by both institutions. The earlier reports are out of print, but can be found in the larger libraries in the annual volumes describing the field operations of the United States Bureau of Soils.

GENERAL CHARACTERISTICS OF NEW YORK FARM LAND

The location of the different types of soil is given in figure 41. The location of the more important developments in agricultural production is shown in figure 38, which may also serve as a basis in discussing the geography of the State. The State may be roughly divided into three parts: namely, one-half in timber and in rough, broken, mountainous, waste land; one-sixth in cultivated crops; and one-third in hay and pasture.

The rough, mountainous land is in three main masses: namely, the Adirondacks, the Catskills, and the highlands of the lower Hudson. These

FIG. 40. KEY TO THE AREAS COVERED BY SOIL SURVEY IN NEW YORK WITH THE DATE WHEN THE SURVEY WAS MADE

Reports are distributed by the Superintendent of Documents, Washington, D. C., and by the Congressman for the district in which the survey is located; those published since 1912 may also be obtained from the New York State College of Agriculture

are non-agricultural lands in the sense of not being extensively suited to cropping purposes. It is true that in some of the valleys there are small irregular areas of tillable land, part of which is of very good quality, but as a whole these regions may be classed distinctly as land suited only to forest purposes.

There is no sharp regional distinction between the other two parts of the State. The cultivated land is distributed among the areas of hay and pasture land. However, the largest areas of hay and pasture land are in the regions where the land is poorest in quality, where the prices are lowest, and consequently where the purchaser should exercise most

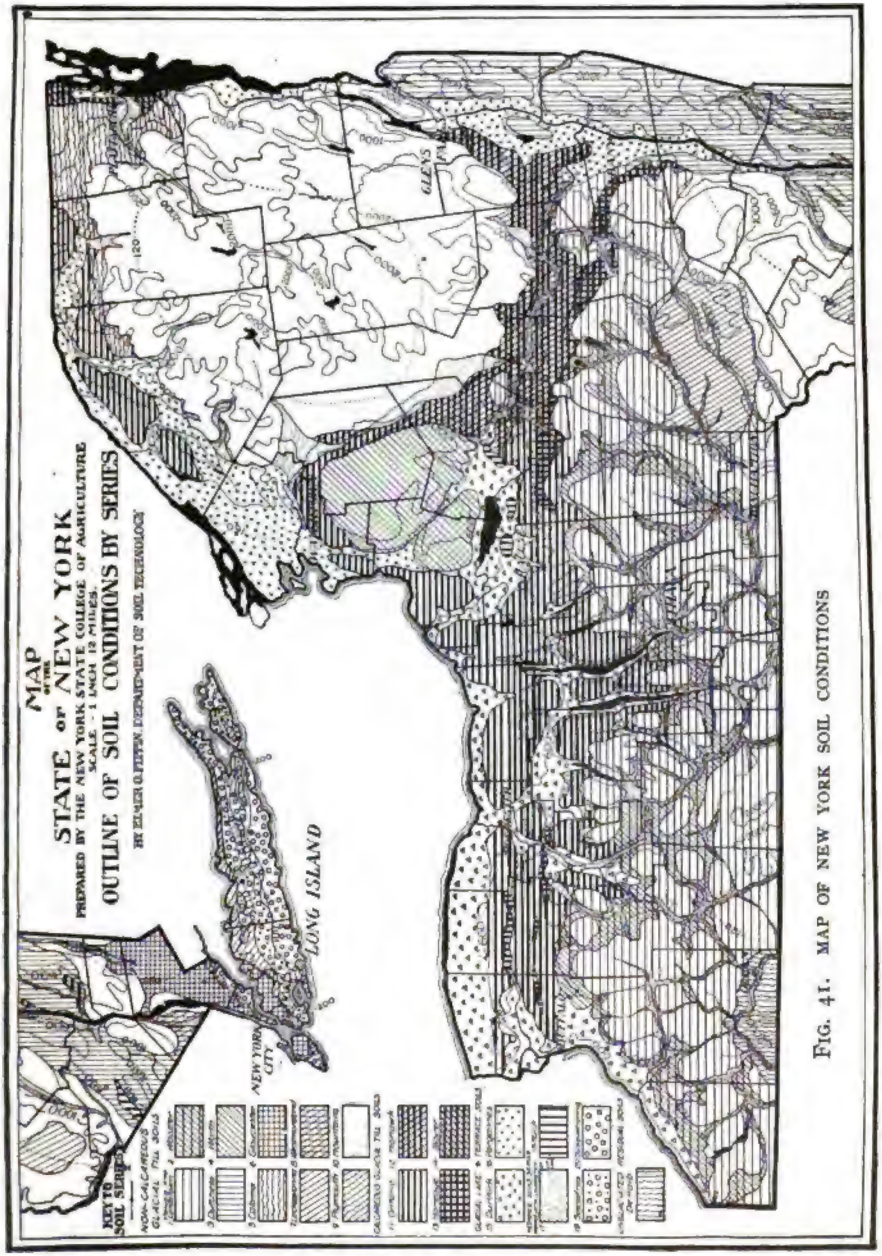

FIG. 41. MAP OF NEW YORK SOIL CONDITIONS

care in selecting a farm. In general, the land adjacent to the mountain areas and which has the higher average elevation, is the land of poorest quality and lowest value. Conversely, the best land is found at the lower elevations along the lakes and in the larger valleys.

In every county there are good land and good farms. In some counties the proportion of good land runs very high, for example, in the belt twenty to forty miles wide from Buffalo eastward to Albany. In other counties the proportion of poorer land exceeds the proportion of good land. The prospective purchaser may therefore expect to find good farms as well as poor farms in all parts of the State, and he must exercise much discrimination in making a selection.

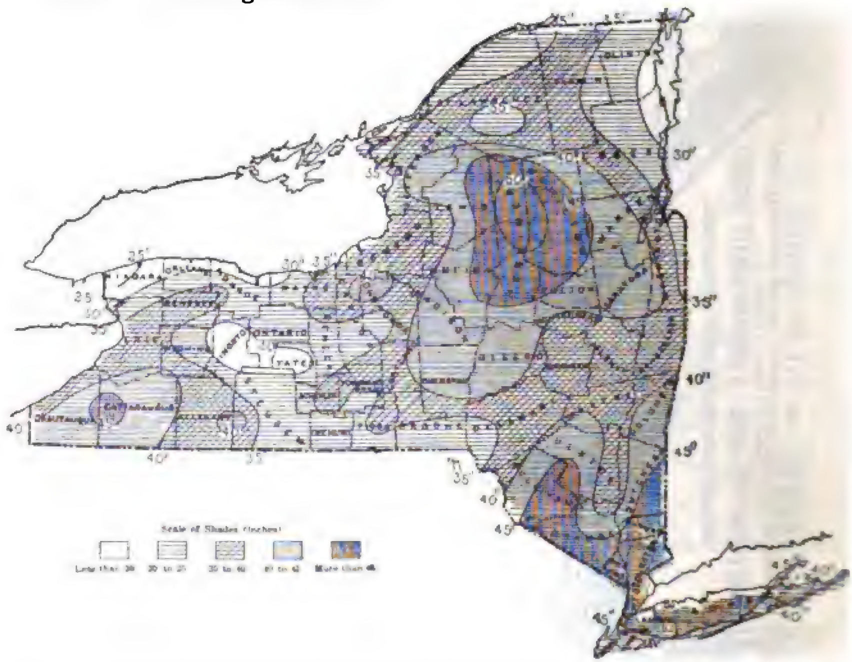

FIG. 42. MAP OF NEW YORK STATE, SHOWING THE ANNUAL DISTRIBUTION OF RAINFALL

SOME REASONS FOR THE WIDE RANGE IN THE PRICE OF LAND

The following are the primary reasons for the wide range in the value of farm land, and should be kept clearly in mind in studying areas for prospective purchase: elevation and climatic conditions; roads, distance from cities and shipping facilities; character and productive capacity of the soil.

All of New York State has been settled for a hundred years and the eastern part for a much longer time; and if in some regions land values

are high and population is dense, while in other regions the values are low and population is less than formerly, there is some very definite reason for the condition that should be sought out and studied. Real as those conditions may be, the increased demand for farm produce and the increased knowledge of how to deal with questions of soil productiveness, together with improved roads and farm machinery, may justify the taking up of some areas once neglected.

ELEVATION AND CLIMATIC CONDITIONS

Two-thirds of the surface of New York has an elevation of more than 1000 feet above sea level. The mountain areas have elevations of from

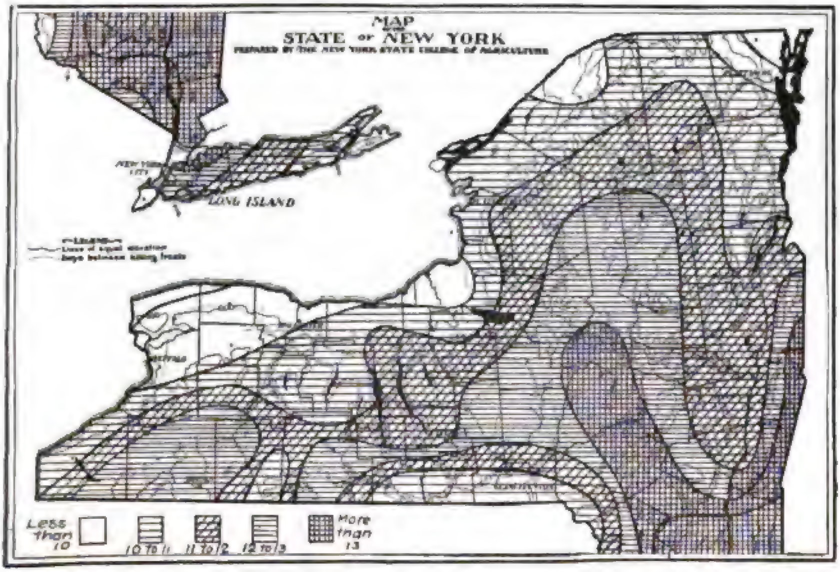

FIG. 43. MAP OF NEW YORK STATE, SHOWING THE DISTRIBUTION OF RAINFALL DURING THE THREE CROP-GROWING MONTHS, JUNE, JULY, AND AUGUST

3000 to over 5000 feet in their highest parts. The hills are seldom precipitous but have a rounded outline with rather mild slopes over the higher parts. They are separated by numerous deep valleys, usually broad in outline but sometimes with a rather steep rise to the first level.

The land temperature within several miles of the larger lakes is tempered by them. The valley lands and those of lower elevation are protected from severe winds and from the extreme rigors of winter. There is considerable snow, which is most abundant and lies on the ground most continuously in the regions of the higher rainfall. The snow covering is also more persistent at elevations above 1000 feet than below that level. The summers are generally comfortable and are not often subject

to high temperatures. The higher and more exposed hills have a cold, bleak winter season, with much snow, and the summers are short and cool. This limits the kinds of crops that can be grown. The valleys in the plateau regions, even tho they may have a rather low elevation, are inclined to be frosty, due to the flow of cold air from the hill country. Consequently, late spring and early fall frosts may be expected and interfere with the growth of crops sensitive to frost.

These conditions, when combined with the soil conditions that prevail in the higher hill regions, have led farmers to keep a large part of their area in pasture and hay, in forage and small grains for stock feed, and in buckwheat and potatoes. This combination of crops is best utilized by livestock, and consequently in those regions the largest number of cattle, mostly cows, is kept. They are the leading dairy regions.

The Great Lakes plains, the Finger Lakes region in west central New York, the Mohawk and the lower Hudson Valley, have an elevation of from 200 to 1000 feet. The surface ranges from slightly undulating to distinctly hilly. There are few large areas of flat land. In the western and in the southeastern part of this plains region the summer climate is drier and warmer than in other parts of the State, and that fact has led to the larger development of crops and fruits for cash sale. These are the regions of highest farm land values.

ROADS, MARKETING AND SHIPPING FACILITIES

For its area, New York has a large mileage of both wagon roads and railroads. In order to take advantage of the easier grade, the main lines of both types of road follow the lower plains, the valleys, and the lower passes thru the hills. The irregular topography forces these roads to follow a winding course rather than straight lines, as is the custom in the flat country of the Middle West. The higher hill lands are less well served by roads than is the land of lower elevation, and their remoteness from main lines of travel has resulted in a smaller proportion of improved roads on the hills. These roads are likely to have sharp grades that interfere with the movement of large loads. The distance of a farm from a city or a shipping station must be measured in terms of the height and steepness of the hills to be traversed. The nature of the soil and of the underlying strata in most parts of the State is such that with moderate care under the money system of road taxes that is in operation, the roads seldom become impassable to a team.

Steep roads are an even more serious barrier to travel, especially with a load, than are miles of distance. Where the valley walls are steep and special care has not been taken to lead the road up the slope by an easy grade, the movement of freight is much handicapped. The movement

of crops downhill to the station is not so serious as the movement of necessary supplies to the farm. Rather large amounts of supplies such as lime, drain tile, and fertilizer, are required to put much of the cheaper land in the best possible productive condition. The extension of the system of macadam highways under state subsidy is reducing this handicap to a considerable extent, but these improved roads, like the railroads, are kept largely in the valleys.

CHARACTER AND PRODUCTIVE CAPACITY OF THE SOIL

The variation in intensity of development of the agricultural regions of the State very closely reflects the variations in the natural productive

FIG. 44. NEW YORK LEADS IN THE PRODUCTION OF HAY

capacity of the soil. This development is, of course, modified by climate and proximity to railroads and cities, but the soil always stands out as a dominant influence. This relation is quite as clear in those large areas of intensive development and high prices for land as in the regions of cheap lands.

The four primary features that determine the crop-producing capacity of the soil are depth and physical character of the soil, distribution of lime, natural drainage, the supply of organic matter and of plant nutrients.

The best farming regions and those in which land commands the highest price for strictly farming purposes, have all these conditions in good natural adjustment. All conditions of the soil can be improved by treatment, but this involves expense that adds to the cost of the land, especially

FIG. 45. IN THE BEAN-GROWING REGION OF WESTERN NEW YORK

FIG. 46. IN THE GRAPE BELT IN NORTHERN CHAUTAUQUA COUNTY

FIG. 47. A VALLEY IN EASTERN NEW YORK

if more than one line of treatment must be extensively applied. This might be laid down as an important distinction between the better and higher-priced land and the poorer and lower-priced land. The one class requires only one or two lines of treatment, while the other class is likely to need treatment along all lines and may present severe difficulties in their application.

DEPTH AND PHYSICAL CHARACTER OF THE SOIL

The best land has good depth, from five to more than one hundred feet; is of intermediate fineness, ranging from light sandy loam thru fine sandy loam and silt loam to heavy loam; and is fairly open and friable,

FIG. 48. CLAY AND SAND SOIL INTERSPERSED WITH OUTCROPS OF ROCK IN THE ST. LAWRENCE VALLEY REGION

without pronounced hardpan or impervious properties within a depth of several feet from the surface. It may be stony, but does not contain enough stone to seriously interfere with tillage operations. There are very few large areas in New York that are not stony to a degree.

The unfavorable physical conditions for which the purchaser should be on the lookout are tenacious heavy clay, loose, deep clean sand or gravel, and a compact impervious condition of the soil within three or four feet of the surface, particularly if it begins within the surface foot and extends to a depth of several feet or to bedrock.

There is not much heavy clay land in New York. There are scattered areas of clayey soil, some of them of fairly large extent, for example,

east and northeast of Buffalo, in the Genesee Valley, south of Oneida Lake, along parts of the St. Lawrence River, in parts of the Lake Champlain Valley, and in the Hudson Valley from near Hudson northward. But even these areas have usually a silty clay loam soil and do not exhibit the tenacious gumbo properties shown by soils in some other parts of the country. Nor are these clay areas always flat. Their surface is usually undulating due to erosion that has occurred. Such lands present especially the problem of drainage with some need of lime and humus.

Light sand and gravel areas are widely distributed but are generally of small extent. The most notable exception is a sand plain of distinctly low agricultural value situated in the middle of Long Island and having

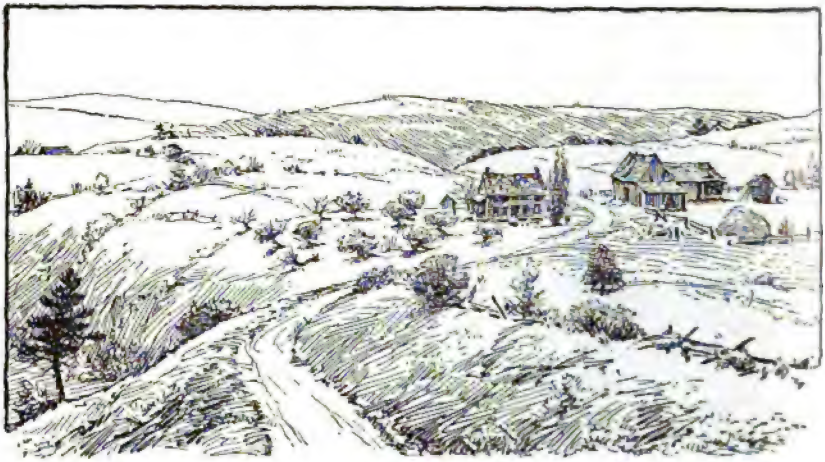

FIG. 49. A COMMON TYPE OF THE SO-CALLED ABANDONED FARMS OF THE MORE REMOTE HILL REGIONS

an area of nearly half the island. Only its proximity to New York City relieves it somewhat from an even more uninviting condition than now prevails. Here, as on much sandy land one is easily misled by the apparently favorable character of the silty to fine sandy loam topsoil. This topsoil has good possibilities for improvement, but the loose, porous material that occurs below tells the story and should generally warn one away from such land for serious farming purposes. As a rule, the natural productive capacity of such land is directly proportional to the depth of the fine topsoil, and only where it exceeds a depth of three feet may one with much hope of success ignore the poor quality of the material below. Such land is leachy and drouthy. It lacks both humus and lime, and for intensive cropping should be irrigated. Often such land is marked by a billowy sand dune topography and naturally bears a

sparse scrubby vegetation. Up state there are a few such areas, notably a small one east of Rochester, the plains east and north of Oneida Lake, the ancient deltas of the larger streams coming out of the Adirondack Mountains on all sides, the Mohawk delta between Schenectady and Albany, the Saratoga sand plains, and a few scattered small gravel flats in the larger valleys of southern New York. Usually, the poorer soils of porous character are closely associated with good land.

Depth and the occurrence of hardpan conditions require most attention in the hills of southern New York and in the farming sections of the Hudson Valley. Around the base of the larger mountain areas, this condition is always a possibility. Further, since all New York has been covered by glacial ice, it is to be expected that the rough rock floor will in some places be swept bare of soil covering so that ledge rock is exposed at or near the surface, while close at hand there may be a good depth of soil. This irregularity in depth is most pronounced in the eastern and northern parts of the State.

FIG. 50. LIME IS REQUIRED BY THE SOIL OF A LARGE PART OF THE STATE FOR BEST RESULTS

Over the highlands of southern New York west of the Catskill Mountains, a common condition is the occurrence of a compact layer of soil having distinct hardpan properties within one or two feet of the surface. The hardpan material is a compact mixture of shale fragments, fine sand, and fine earth — clay and silt. This holds water and thereby produces a poorly drained condition evidenced by springs, especially in the forepart of the summer season, and by a mottled appearance of the soil just above the hardpan layer. Such land requires underdrainage and is also likely to require lime and humus as well as some fertilizer. This land with the shallow soil is about the lowest-priced agricultural land in the State. It lies on the higher hill slopes, as well as over the tops of the larger hills.

Such land is not to be confused with that of similar surface appearance and position, but which is essentially free of hardpan and has a uniformly oxidized appearance to a depth of several feet. Thru the notches and larger valley troughs of this hill region there are large areas deeply filled with such soil, the chief needs for the improvement of which are lime and humus, with some local drainage and a little fertilizer. These latter lands are the best for farming in the southern hill country.

FIG. 51. A FREQUENT RELATION OF THE FARMSTEAD AND THE HILL LAND OF THE FARM IN SOUTHERN NEW YORK

It is not possible to clearly differentiate all these classes of soil on the map (fig. 41). With the key to the map, the following designations may be helpful. The heavy clay and the light sandy and gravelly lands are comprised within the glacial lake and terrace division but form rather a minor part of those regions (nos. 15, 16, 17, 19, and 20). Those likely to have thin or hardpan conditions are chiefly in the Dutchess, Worth, Coloma, Volusia, and Lackawanna series, while the Lordstown, Wooster, Fox, and Chenango series comprise the deeper and better portions of the southern plateau region.

FIG. 52. ON THE CALCAREOUS SOILS IN THE MOHAWK VALLEY REGION

DISTRIBUTION OF LIME

There is a wide range in the distribution of lime in the soils of the State. Limestone is the underlying rock in but small areas, but the distribution of fair amounts of lime in the soil

is not limited to those areas. The formation of the soils thru glacial agencies has distributed lime carbonate in soils, especially in subsoils, far beyond the boundary of the underlying limestone. The soils with a fair supply of lime generally have the higher productive capacity, and they predominate in the best farming regions. While there may be some need of lime on such soils, it is confined to the topsoil, where it can be readily applied. All the subsoils in those regions are rich in lime carbonate; and when good drainage is provided, that lime becomes available to the deeper-rooted crops. In the map (fig. 41) all the soils marked as calcareous glacial till (nos. 11, 12, 13, and 14) have a fair to good supply of lime, and the Honeoye series (no. 13) is especially rich in lime carbonate in all its members. All the heavier types of the glacial lake series (nos. 15 and 16) have a moderate supply of lime in the soil and a large supply in the subsoil below two or three feet. The sandy and gravelly soils are usually very deficient in lime. The valley terrace soils (no. 17) also vary in lime content according to type and are a little more deficient than the other soils of this division. The first bottom soils, which are not separately shown, are not so acutely in need of lime as are most of the adjacent soils.

FIG. 53. MUCH RYE IS GROWN IN THE HUDSON VALLEY

FIG. 54. DRAINAGE IS ONE OF THE BEST MEANS OF IMPROVING THE PRODUCTIVENESS OF MUCH LAND IN NEW YORK

The soils marked on the map as noncalcareous glacial till and the marine and residual soils (nos. 1 to 10 and 19 to 21) all need lime for the successful growth of leguminous crops or crops sensitive to acid conditions. There is a considerable range in these soils in their need for lime. The Wooster soils are usually in better condition than any of the other series in this division. The Volusia-Lordstown soils have great need for lime, as have also the Worth, Coloma, Gloucester, and Lackawanna soils. In fact, lime is a prerequisite to successful cropping on almost any of the soils in this division. Most of them were formerly much more productive soils than at present because they had the virgin supply of lime in the top layer, but this was small and has been largely exhausted in two or three generations of cropping. As a rule, the higher the elevation of the land, the greater is the need for lime. There are of course exceptions to this rule, and the reverse may be true. The movement of soil material from the northern limestone districts by glacial action was stronger in the valleys than over the hills.

The type of vegetation on the land is a good index to its lime supply. Where clover and bluegrass are common, and where black locust and basswood trees are found, the lime supply is fair to good. Where poverty grass (*Danthonia spicata*), white daisy (*Chrysanthemum leucanthemum*), devil's paintbrush, or orange hawkweed (*Hieracium aurantiacum*), and sorrel (*Rumex acetosella*) are the prevailing small vegetation, and where the chestnut is a common tree, the lime supply is very low. Under these latter conditions, the subsoil, as well as the soil, is deficient in lime, and this condition is difficult to correct. Nearly all the land in the State may be benefited by some application of lime.

NATURAL DRAINAGE

The area of actual swamp land in the State is relatively small and is widely distributed. In the tilled parts of the State there are many small areas that need supplementary drainage. New York is a well-watered State, springs abound, and good wells of water may be made in nearly every section. Where this underground water comes to the surface, due to a rock ledge or a compact layer of soil, it produces a springy area that needs drainage.

If the subsoil is a heavy clay or a hardpan material, the surplus water is held near the surface, delays tillage operations, and hinders crop growth. Hill land, quite as much as flat land, may need drainage, and one considering the purchase of any heavy or compact soil, even tho it has a good slope, should keep in mind the possible need for drainage. Drainage is one of the most practicable means of increasing the productive capacity of much New York land.

THE SUPPLY OF ORGANIC MATTER AND OF PLANT NUTRIENTS

Lack of organic matter is one of the primary limiting factors in crop yield in the eastern States, as well as in other sections of the country. The common practice is to destroy that material more rapidly than it is returned in crop residues and manures. Depletion of organic matter also means the reduction of the supply of combined nitrogen, which is the most common limiting factor in crop yields in all parts of the country. A dark-colored soil is usually regarded as a fertile soil because the color generally indicates the presence of organic matter in the form of humus, which in turn suggests the presence of a large supply of available nitrogen. The supply of organic matter in New York soils varies from a very high proportion in muck and peat land, which is distributed in numerous

FIG. 55. CELERY ON MUCK SOIL
There are numerous areas of swamp land in many of which is muck soil that is especially suited for the production of truck crops. This soil will also produce good yields of timothy

small and a few large areas, thru all the grades of black and dark-colored soils to those having a light yellow, gray, or brown color, indicating the presence of a small supply of humus.

As a rule the soils best supplied with lime have the darker color. Defective drainage aids in the accumulation of humus and therefore is responsible for dark color. Conversely, the soils most deficient in lime are lighter in color and often lack humus. This is due partly to the fact that there is a larger natural growth of vegetation on lime-rich soils and a larger proportion of leguminous plants in the vegetation, and partly to the fact that in such soils there is better formation of humus from the organic material and larger conservation of it thru the action of the lime.

Where there is a fair supply of lime and fair drainage, legumes can be successfully grown to build up both the organic matter and the nitrogen. Lack of these materials therefore is not in itself a serious objection to land, but they are commonly needed. The color of the soil is often suggestive of its possibilities. The poorer and the cheaper lands are usually low in their supply of organic matter because they lack lime and sufficient drainage. On the other hand, light, sandy and gravelly soils are deficient in organic matter because they lack lime and because of their porous, drouthy character, which not only promotes rapid decay but provides a small growth with which to build up the soil. The common deficiency in organic matter in New York is therefore not to be considered in itself a primary objection, but should be considered in connection with the possibility of building up that constituent.

FIG. 56. SOME STEEP HILLSIDES ARE FARMED

Of mineral plant nutrients — phosphoric acid and potash — most New York soils have a large total supply. This is especially true of potash, except on muck soils, which are everywhere deficient in that constituent. The one mineral element to which the largest areas of land respond is phosphorus, and the soils in all parts of the State are similar in this respect. It is important on the better soils as well as on the poorer soils, and it is the least expensive mineral to apply. The cheap lands very generally respond to applica-

FIG. 57. NEW YORK LEADS IN POTATO PRODUCTION

tions of phosphorus in the form of acid phosphate. However, the rather large total supply of phosphorus in the soil and subsoil of nearly all areas of land, suggests the importance of drainage where needed and of all those means that insure deep rooting of crops. The phosphorus supply is less a problem in soils of New York than of most States and need not be a dominant problem in selecting a farm.

AGRICULTURAL DEVELOPMENT AND SOCIAL CONDITIONS

Land prices reach as high a maximum in parts of New York as in any other part of the eastern United States. The best fruit and trucking lands favorably situated for marketing command the highest prices. These range from two or three hundred to one thousand dollars per acre. Such land is found most extensively in the western fruit belt south of Lake Ontario and along the shore of Lake Erie, in the middle, or fruit, section of the Hudson Valley from Newburgh northward to Albany, and on the western end of Long Island in the market garden section. In the best regions of mixed and general farming, which lie just south of the western fruit belt, especially south of Lake Ontario and thru the Mohawk Valley section, with minor areas in the valley regions of northern, southern, and eastern parts of the State — the value of the better farms having fair buildings is from one hundred to two hundred dollars per acre. Two other general divisions may be made. The less favored farms in the best regions and those in the better parts of the hill and valley sections range in price from forty to one hundred dollars per acre. The most remote farms, often on hills, still within the range of cultivation constitute the last division and are valued at from ten to fifty dollars per acre. This land has the most disadvantages. The land commanding a medium to good price is generally considered to afford the best business propositions. Such land has greater possibilities for improvement, is easier to improve, and is better situated in regard to transportation facilities and social centers.

The farmer must consider the educational and social conditions surrounding his farm because it must also be his home. These generally improve with the prevailing price of the land. At the lower elevations and near villages and cities, they are best. At the higher elevations and in the remote valleys, population is more sparse, and all the facilities of social and intellectual improvement are more meager.

Rural mail delivery and telephone service are very generally available in farming districts. The heavy forest covering that formerly prevailed thruout the State has favored the erection of substantial buildings on nearly every farm, and on many they are notably commodious and constitute one of the attractive features of New York lands, even in the region of the lower prices.

The swing of economic change was for thirty years away from the more difficult tilled parts of New York and the eastern States in general. But the better and more easily tilled parts of the State have held their own very well against the severe competition of low-priced western and middle western lands, and in recent years have correspondingly increased in value. The increased demand for farm products, the advancing prices of farm products, and the advantages that eastern land enjoys of proximity to large markets, are bringing back into the range of profitable tillage land that for a time was of necessity largely neglected. The return follows the same principles as the exodus of farm activity. It first touches the better land that was last to be neglected; and it will in time come to the poorer lands that in the main were first affected by the depression in agricultural prices.

With these facts in mind, the prospective purchaser may look to New York farm land as a business investment as well as a homestead. Having decided on the type of farming in which he wishes to engage, and the personal conditions he would impose, he may hope to find many places that are reasonably satisfactory, by studying the many and differing sections as to soil, climate, equipment, and general situation. The wider the range of conditions presented, the more the nature of these differences must be kept in mind, and the more careful should be the search for a suitable place.

FIG. 58. THE BEST TYPE OF FARM BUILDINGS FOUND IN SOME OF THE REGIONS OF HIGH-PRICED LAND

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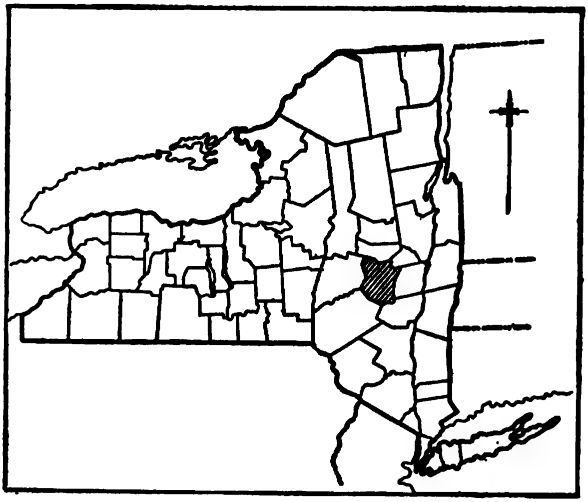
In cooperation with the United States Department of Agriculture, Bureau of Soils

Soil Survey of Schoharie County New York



The shaded part shows the location of the surveyed area

E. T. Maxon, of the U. S. Department of Agriculture, and
G. L. Fuller, of the New York State College of Agriculture

Under the direction of
Elmer O. Fippin

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RESOLUTION PROVIDING FOR THE FEDERAL PUBLICATION AND DISTRIBUTION OF SOIL SURVEY REPORTS

[PUBLIC RESOLUTION — No. 9]

JOINT RESOLUTION amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

EXPLANATORY STATEMENT

The subjoined is a report on the Soil Survey of Schoharie County, accompanied by a large-scale map in colors showing the distribution of the several types of soil recognized and described. This survey was made by E. T. Maxon, representing the Bureau of Soils of the United States Department of Agriculture, and G. L. Fuller, representing the Department of Soil Technology of this College. The work was done in cooperation with the United States Bureau of Soils, of which Milton Whitney is Chief, Curtis F. Marbut is in charge of Soil Survey, and W. E. McLendon is Inspector of the Northern Division. A limited edition of this report is published by the United States Department of Agriculture as a separate from the Field Operations of the Bureau of Soils, but this College has none of these reports for distribution.

A. R. MANN,
Dean.

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ILLUSTRATIONS

SOIL SURVEY OF SCHOHARIE COUNTY, NEW YORK

By E. T. MAXON, of the U. S. Department of Agriculture, In Charge, and G. L. FULLER, of the New York State College of Agriculture.—Area Inspected by W. E. McLENDON

DESCRIPTION OF THE AREA

Schoharie County is situated in the eastern part of New York. It is bounded on the north by Montgomery County, on the east by Schenectady, Albany, and Greene Counties, on the south by Greene and Delaware Counties, and on the west by Delaware and Otsego Counties. The county embraces an area of 620 square miles, or 396,800 acres.

The northern part of Schoharie County consists of a strongly rolling plain lying at an elevation of about 1,200 feet. It is dissected by a few valleys cut to a depth of 500 to 600 feet below the upland and many small ones ranging from mere sags to valleys as deep as the main valleys. The dissection is neither minute nor sharp. Standing on this plain are a number of isolated roundish hills ranging in height to about 600 feet above the plain.

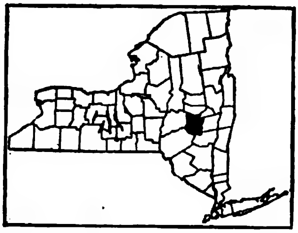

FIG. 59.— Sketch map showing location of the Schoharie County area, New York

The southern three-fourths of the county consists of a high plateau lying a little above 2,000 feet, or about 800 feet above the northern plain. It is terminated on the north by a steep escarpment in which the surface drops to the level of the northern plain. The southern plateau is deeply dissected by large and small streams, the dissection being more thorough and more sharply incised than is that of the northern plain. There is a much larger proportion of steep slope in this region and a smaller proportion of smooth to rounded or rolling surface than in the northern plain. Along the extreme southern border of the county there are a number of prominent hills rising to heights ranging to more than 3,000 feet. These are outliers of a still higher plateau to which the surface rises a short distance south of the county line.

Practically the entire county, with the exception of the extreme northeastern part, is adequately drained. The principal streams are Schoharie and Cobleskill Creeks, which have numerous small tributaries rising in the uplands and flowing swiftly through narrow, deep-cut valleys. Schoharie and Cobleskill Creeks follow a northeasterly course, the former through the eastern part of the county

and the latter through the northern part. The drainage of most of the county is carried by Schoharie Creek into the Mohawk and Hudson Rivers. That of the southwestern part flows into the Susquehanna and Delaware Rivers. Nearly every stream in the county is utilized for water power during some part of the year.

The first permanent white settlement in Schoharie County was made near the site of Middleburg about 1713 by Germans. The rich lowlands appealed to these hardy pioneers and soon attracted many Germans and Dutch from the old country. These were followed by emigrants from the New England Colonies, Connecticut especially. The English soon established a colony on the southern border of the county, not far from Stamford, Delaware County, and other settlements were established along the watercourses. Following the early wars settlement was rapid, but during the last 50 years the population has gradually decreased. In 1880 the census reported a total population of 32,910, which in 1910 had decreased to 23,855, a loss of 9,055 in 30 years. This can probably be explained in large part by the fact that the younger generation has moved to the cities. About 75 per cent of the population is rural. The density of rural population is given by the census as 37.2 persons per square mile.

The present population is made up largely of descendants of the pioneers. Some of the abandoned farms in the eastern part of the county are being taken up by Swedes and Poles.

The largest towns in the county are Cobleskill, with a population in 1910 of 2,088; Middleburg, with 1,114; and Schoharie, with 996. Schoharie is the county seat. Little or no manufacturing is carried on in these places, the inhabitants being mostly retired farmers.

Most of the county has good transportation facilities. The Delaware & Hudson traverses the northern part of the county from east to west, with a branch line extending into the northwestern corner; the Middleburg & Schoharie traverses the eastern part in a southerly direction; and the Ulster & Delaware follows the southern boundary for a short distance. The main State road from Albany to Binghamton passes through the Cobleskill Valley. Other State roads are under construction or projected. The dirt roads in the northern part of the county are in good condition, and are much better than those in the southern part.

Schenectady, Albany, and New York are the principal markets for the products of the county.

CLIMATE

The nearest Weather Bureau stations are located at Cooperstown, about 25 miles to the west, in Otsego County; and at Albany, about miles to the east, in Albany County. The records for Coopers-

town, which has an elevation of 1,200 feet above sea level, are representative of the conditions over the greater part of Schoharie County, while the Albany records probably apply more closely to the region along Schoharie Creek, in the eastern part of the county.

According to these records, the mean annual temperatures at Cooperstown and Albany are 43.9° F. and 48.2° F., respectively. The winters are long and severe, while the summers are mild and pleasant. The average dates of the last killing frost in the spring at Cooperstown and Albany are May 5 and April 23, and of the first in the fall, October 3 and 17; while the latest dates on record of killing frosts in the spring are May 24 and 30, and of the earliest in the fall, September 15 and 23, respectively. The growing season is long enough to mature most of the crops grown in this general region.

The rainfall is ample and evenly distributed throughout the growing season. At Cooperstown the mean annual precipitation amounts to 39.82 inches, and at Albany 38.39 inches.

The following tables give the normal monthly, seasonal, and annual temperature and precipitation at Cooperstown and Albany:

Normal monthly, seasonal, and annual temperature and precipitation at Albany

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1905)	Total amount for the wettest year (1871)	Snow average depth, Dec. 1884–Feb. 1903
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	28.0	66	−17	2.67	1.36	1.65	11.2
January	23.4	64	−24	2.61	2.66	2.30	12.8
February	24.4	63	−18	2.47	0.80	2.00	13.4
Winter	25.3	66	−24	7.75	4.82	5.95	37.4
March	33.3	79	− 8	2.75	2.43	7.29	11.1
April	46.7	88	13	2.67	2.12	3.79	1.2
May	59.2	93	29	3.50	0.96	4.97	T.
Spring	46.4	93	− 8	8.92	5.51	16.05	12.3
June	68.4	99	40	4.03	3.58	7.25	0
July	72.3	100	48	4.12	2.00	9.37	0
August	70.5	98	42	3.82	3.83	10.59	0
Summer	70.4	100	40	11.97	9.41	27.21	0
September	62.5	96	32	3.37	3.37	0.85	0
October	50.2	90	23	3.41	2.38	3.34	T.
November	39.1	71	−10	2.97	1.49	3.38	4.7
Fall	50.6	96	−10	9.75	7.24	7.57	4.7
Year	48.2	100	−24	38.39	26.98	56.78	54.[illegible]

Normal monthly, seasonal, and annual temperature and precipitation at Cooperstown, N. Y.

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year	Total amount for the wettest year	Snow, average depth
	°F.	*°F.*	*°F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	24.6	62	−30	2.85	3.27	4.33	13.1
January	20.2	62	−33	2.60	1.68	4.39	14.1
February	20.6	57	−28	2.48	0.85	2.91	18.7
Winter	21.8	62	−33	7.93	5.80	11.63	45.8
March	28.0	76	−16	2.82	2.29	4.17	12.8
April	41.2	82	14	2.72	2.19	2.86	2.4
May	54.6	87	23	3.65	3.40	8.84	0.1
Spring	41.3	87	−16	9.19	7.88	15.87	15.3
June	64.0	90	30	4.20	1.00	4.89	0
July	68.1	94	39	4.55	1.79	3.39	0
August	65.4	90	35	3.15	5.81	6.01	0
Summer	65.8	94	30	12.90	8.60	14.29	0
September	58.3	87	27	3.40	2.88	7.24	0
October	46.7	80	17	3.35	2.39	5.91	0.7
November	35.0	70	0	3.05	2.37	3.17	5.2
Fall	46.7	87	0	9.80	7.64	16.32	5.9
Year	43.9	94	−33	39.82	29.92	58.11	67.0

AGRICULTURE

The early settlers of Schoharie County cleared small patches of land in the valleys. Wheat and corn, the first crops grown, did so well that larger areas were cleared, the timber being thrown into piles and burned. The production of grain continued until the competition of the larger grain-producing sections of the West made it unprofitable.

In the early part of the nineteenth century the growing of hops on a commercial scale was entered into, and hop growing became the leading industry, but during the last 25 years the low prices, combined with the keen competition of the far West and the loss from plant diseases, have forced the growers of hops to reduce their acreage and turn to diversified farming. At the present time dairying is the most important industry, the chief products being raw milk and butter.

The following table gives the acreage and production of the principal crops of the county for the census years 1879 and 1909:

Acreage and production of principal crops of Schoharie County, 1879 and 1909

Crop	1879		1909		Crop	1879		1909	
	Acres	*Tons*	*Acres*	*Tons*		*Acres*	*Bushels*	*Acres*	*Bushels*
Hay and forage..	90,446	92,463	95,527	114,376	Wheat.........	5,789	80,467	399	9,334
		Bushels		*Bushels*	Barley.........	1,559	30,157	638	13,582
Oats............	32,804	727,690	25,190	573,010	Potatoes.......	3,575	261,720	3,273	307,746
Buckwheat.....	18,583	293,443	12,312	240,770			*Pounds*		*Pounds*
Corn............	7,602	217,506	5,492	197,520	Hops...........	5,871	2,982,873	3,419	2,156,883
Rye.............	5,941	76,628	2,218	34,207					

Hay and forage are by far the most important crops in the county, being valued in 1909 at $1,321,364. Approximately 60 per cent of the hay produced in 1909 consisted of timothy and clover mixed and nearly 27 per cent of timothy alone. Most of the mixed timothy and clover is fed on the farm, while the greater part of the timothy is sold.

The acreage devoted to oats in 1909 exceeded that of all the other cereals combined. This crop is grown throughout the county, a part of it being used on the farms and a part being sold. Buckwheat is grown upon nearly every farm, and most of the crop is sold. Corn is grown mainly in small patches in connection with the dairy farms. The production of corn for ensilage is becoming more general.

Beween 1880 and 1900 the hop industry was of considerable importance, an average of 5,798 acres being devoted to it annually, with an average annual production of 3,298,186 pounds. Nearly every farmer had a hop "yard." Owing to low prices and increased cost of production, however, there was a considerable decrease in acreage and production during the decade from 1900 to 1910. At the present time this industry is confined to the best soils along the Schoharie and Cobleskill Valleys.

In 1909 the combined acreage in rye, barley, and wheat, amounted to only 3,255 acres, showing a decrease of more than 10,000 acres in the last 30 years.

Alfalfa was grown in 1909 on 267 acres, with a yield of about two tons per acre. In that year there were also produced 219,343 bushels of apples, 58,282 pounds of grapes, and 112,491 pounds of nuts.

The 1910 census reported 40,743 head of cattle in the county, including 26,138 dairy cows. There were also 11,422 sheep and 9,645 hogs in the county in that year. The Holstein is the predominating breed of dairy cattle. The value of dairy products, excluding the milk and cream used at home, was $1,443,765, and the receipts from the sale of dairy products amounted to $1,418,629. The number of poultry raised was 176,000 and the number sold was 73,047. Poultry and eggs produced were valued at $428,454, and the receipts from the sale of poultry and eggs amounted to $329,388.

On the better valley soils the farms are supplied with modern implements and machinery, but this is not generally the case on the hill farms. The buildings on the valley farms also are larger and more commodious than those on the hill farms. Improved cow barns and silos are common. Most of the farm machinery is housed when not in use.

The farming methods in Schoharie County do not differ materially from those of the hill regions throughout southern New York. Plowing is done both in the fall and spring, the depth of plowing varying from 3 inches on the poorer soils to 6 or 8 inches on the better land. Most of the seeding is done in the spring.

The importance of crop rotation is not yet generally recognized. On the valley farms the usual practice is to grow corn one year, oats the following year, and then allow the land to remain in grass for several years, or until it runs out. On the hill farms the usual procedure is to grow buckwheat or oats for one year and then leave the fields in grass until it runs out. Pastures receive little or no attention. Hops are usually grown on the same fields for long periods.

In 1909, according to the census, the total expenditure for commercial fertilizer was $32,225, or $24.19 per farm reporting. The crops for which commercial fertilizers are most regularly used are hops, oats, and corn. Ground limestone is used to some extent.

In 1910, 72.7 per cent of the farms reported the use of hired labor, the total amount spent for this purpose being $552,050, or $230.89 per farm reporting. Permanent laborers are hired for a period of seven or twelve months, the wages varying from $25 to $40 per month, with board. Wages paid day labor during the harvest season are at a higher rate.

In 1910 there were 268,179 acres reported in farms, of which 185,293 acres consisted of improved land. The number of farms in the county was 2,495, and their average size was 112.9 acres. Nearly 76 per cent of the farms are operated by owners, and nearly 23 per cent by tenants. Farms are usually rented on a share basis, the owner furnishing the land, one-half the seed and commercial fertilizer, and part or all of the dairy stock, and receiving one-half the gross returns.

Farm lands vary in value according to location and improvements. The highest priced land in the county is probably in the Schoharie Valley, between Middleburg and Central Bridge, where it is valued at $150 to $225 an acre. Farm lands in the Cobleskill Valley, especially near the towns, sell for $75 to $150, and those in the vicinity of Seward and Sharon Springs for $35 to $60 an acre. In the southern part of the county farm land can be bought for $8 to $20 an acre. Very few farms are changing hands at the present time. The 1910 census reports the average value of farm property in Schoharie

County as $4,396, of which 36.9 per cent represents land, 37.9 per cent buildings, 7.6 per cent implements, and 17.6 per cent domestic animals. The average value of farm land is given as $14.36 an acre.

SOILS

Schoharie County extends from the comparatively smooth, rolling Mohawk lowland belt across the high, hilly Allegheny Plateau region into the rough foothills of the Catskill Mountains. The entire region was glaciated during the late Wisconsin stage, resulting not only in a greatly modified general topography, but in the displacement of all preexisting soils by a mantle of glacial débris. The present soils, with the exception of small areas of cumulose material, are derived from this glacial material, either weathered in place or reworked and redeposited by water. The soils derived from glacial till occupy the uplands, while those derived from water-deposited material occur as smooth terraces at low elevations in plainlike to badly dissected areas in the Schoharie Valley, which seem to be remnants of an old glacial-lake plain, and as narrow overflow plains along all the streams in the county.

The substructure of the county consists of a large number of sedimentary formations, ranging in geologic age from early Silurian to late Devonian. Most of the lowland belt in the northern part of the county is occupied by gray shales and shaly sandstones of the Hudson River Group and by the black Utica shales, which are highly carbonaceous and moderately calcareous. Immediately south of this belt is a strip 2 to 6 miles wide extending across the county by Sharon Springs, Sharon, Cobleskill, Schoharie, and Gallupville, in which the Helderberg and Onondaga limestones are the dominant rocks, although the Clinton, Niagara, Salina, and Oriskany formations are represented in narrow bands.[1]

Throughout the central part of the county, or the high, hilly section, as far south as the Catskill foothills, the surface rocks are gray sandy shales and flaggy sandstones, classed geologically as the Hamilton formation, and the Catskill region is made up of the Chemung sandstone, Oneonta sandstone, and the Catskill formation consisting of red and gray sandstones and shales.

The glacial till represented in the ground moraine mantling nearly all the upland areas, bears a close relation to the rocks over which it lies, except along the lines of contact between the important formations, where material from one is intermingled with that of the other. As in a residual region where each kind of rock gives a characteristic soil-forming material, the till shows marked differ-

[1] The names of the geological formations and information about their occurrence in the county were obtained from the Preliminary Geologic Map of New York, issued in 1894, and from other works published by the Geological Survey of New York.

ences over the different formations, ranging from gray and noncalcareous over the gray shales and sandstones to bluish gray and highly calcareous where the material is almost entirely derived from limestone and to pinkish or Indian red where it is largely derived from red sandstones and shales. Also the black carbonaceous shales give a characteristic dark gray, slightly calcareous till carrying black shale chips in large quantities.

The material forming the stream terraces, the old glacial lake deposits, and the recent alluvium varies in different sections of the county. Where the drainage is almost entirely from gray sandstone and shale uplands the soil material is brown to yellow in color and rests upon beds of sandstone and shale gravel, and the recent alluvium is brown to dark brownish gray in color, while along the streams rising in the Catskill region the terraces and first bottoms are pinkish to decidedly reddish in color. The lake-deposited material in the Schoharie Valley shows in its reddish cast strong influence from the red sandstones and shales of the Catskill region.

Based on the broader differences in origin and mode of accumulation and important differences as exhibited by color, structure, drainage, and topographic position, the soils of Schoharie County are grouped into several series. The noncalcareous till from the gray sandstones and shales gives rise to two well-drained series, the Wooster, where the till is deep, and the Lordstown, where the depth to bedrock rarely exceeds 3 feet; and to two poorly drained series, the Volusia in the deeper till areas and the Allis in areas underlain by rock at less than 3 feet. In the red sandstone and shale areas the lighter colored soils with a pinkish to brownish cast are classed as the Culvers, and those with a pronounced Indian red color as the Lackawanna series, the latter usually being confined to areas of very shallow till over red sandstone and shales. The black shale till gives rise to the Mohawk series and the highly calcareous till to the Honeoye series, while the soils of mixed sandstone, shale, and limestone origin, with the noncalcareous material predominant, are classed as Ontario. The terraces and best developed flood-plain areas, where the material is almost entirely derived from the gray, noncalcareous rocks, are classed in the Chenango and Genesee series, respectively, while the corresponding soils with a high content of red sandstone and shale material are grouped in the Tunkhannock and Barbour series. The old lake deposits in the Schoharie Valley are not classifiable with the Dunkirk series on account of the peculiar reddish tinge of the soil material. The Schoharie series is made to include soils of this character.

In all, 14 series of soils, embracing 18 distinct types, in addition to areas of Muck, Meadow, Rough stony land, and Rock outcrop, are mapped in Schoharie County.

The Ontario series is characterized by brown surface soils and light brown to yellow subsoils, resting at a depth of 2 to 3 feet upon gray to bluish gray, moderately calcareous till. Throughout the soil section there are scattered fragments of sandstone and shale, and in a few places fragments of limestone. The topography is rolling, or that of drumloidal hills, and the natural drainage is good (see Plate VI, 1). In this series only one type, the silt loam, is mapped in Schoharie County.

The Honeoye series differs from the Ontario in having darker colored surface soils and subsoils and in being derived almost entirely from limestone. Two types, the stony loam and loam, are mapped in this county.

The Mohawk series includes types having brown to dark brown surface soils and grayish brown to dark brownish gray subsoils. The lower part of the subsoil contains varying quantities of black shale fragments, and may also be slightly calcareous. The topography is rolling and natural drainage is good (see Plate VI, 2). One type, the silt loam, is mapped.

The surface soils of the Volusia series are brownish gray to gray, and the subsoils, which usually are somewhat more compact than the surface soils, are yellow and brown mottled or pale yellow in the upper part of the 3-foot section and gray mottled in the lower part. The surface soil and upper subsoil are generally deficient in lime, but in the heavier types the lower subsoil and substratum may be slightly calcareous. Small angular fragments of sandstone occur throughout the soil section. The soils of this series are poorly drained. This series is represented in Schoharie County by three types, the stony silt loam, silt loam, and silty clay loam.

The surface soils of the Allis series are brownish gray to gray or pale yellowish and the subsoils are gray, yellow, and brown mottled, resting upon sandstone and shale bedrock at a depth of 3 feet or less. These soils are the shallow equivalents of the Volusia soils. The Allis silt loam is the only type mapped in this series.

The Lordstown series includes types having light brown to yellowish brown surface soils and yellow to grayish yellow subsoils. Both surface soil and subsoil have a loose, friable structure, and the shaly sandstone forms bedrock at a shallow depth. The topography is rolling to hilly. (See Plate VII, 1 and 2.) Two types are mapped in this series, the Lordstown stony silt loam and silt loam, each with a steep phase.

Morainic deposits with yellow to brown surface soils and yellow subsoils are classified as the Wooster series. These soils are loose, friable, and relatively deep. The topography is rolling. In Schoharie County only one type, the gravelly silt loam, is mapped.

The surface soils of the Culvers series are brown to light reddish brown and the subsoils, which are similar to the surface soils in texture and structure, are pinkish to yellowish brown. Red and gray sandstone and shale fragments occur in varying quantities on the surface and throughout the soil section. The topography is rolling to slightly hilly and the drainage is good. One type, the stony silt loam, is mapped in this county.

The surface soils of the Lackawanna series are brownish red to dark Indian red, with somewhat lighter colored subsoils. The topography is rolling to hilly and mountainous and drainage is good. (See Plate VII, 1.) The series is represented in Schoharie County by one type, the stony silt loam.

The Schoharie series includes types having brown to reddish brown surface soils and mottled subsoils in which pink, red, gray, and brown are the dominant colors. There is little or no difference in the texture of the material from the surface downward, although the subsoil is rather compact and shows the lack of drainage. Little or no stone is present in the soil section. The topography is nearly level to quite rolling and choppy and the drainage is good. These soils are derived from sedimentary material laid down in glacial lakes or in the valleys of ancient streams, the material being largely of red sandstone origin. The series is represented in Schoharie County by one type, the silty clay.

The Chenango series includes types with brown, mellow surface soils and yellowish brown, friable subsoils, resting at a depth of 2 to 4 feet upon beds of sand or gravel, mostly of sandstone and shale origin. The soils of this series occupy a terrace position above overflow and have good natural drainage. The gravelly loam is the only type mapped in this county.

The Tunkhannock series includes terrace types with reddish brown surface soils and reddish brown to Indian red subsoils. These soils have a level topography and are well drained. One type, the very fine sandy loam, represents the series.

The surface soils of the Genesee series are brown to dark brownish gray, and the subsoils are light brown to brown and gray mottled, the heavier members usually being the darker. These soils occupy first bottoms subject to overflow, and are alluvial in origin, being derived from mixed sandstone, shale, and limestone material. The silt loam is the only type mapped in this county.

The Barbour soils differ from the Genesee soils mainly in their peculiar reddish color. They occupy alluvial plains, principally along the creeks and rivers issuing from the Catskill region. One type, the very fine sandy loam, is mapped.

Rock outcrop is a term applied to exposures of the bare rock.

Rough stony land comprises areas that are too rough and stony for cultivation.

Muck comprises decomposed vegetable matter mixed with some mineral matter, accumulated under conditions of poor drainage.

Meadow is a term applied to poorly drained undifferentiated material along stream courses and throughout the uplands.

The following table gives the name and the actual and relative extent of each soil type mapped in Schoharie County:

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Lordstown stony silt loam	97,728	46.4	Meadow	5,504	1.4
Steep phase	86,592		Honeoye stony loam	5,120	1.3
Volusia silt loam	39,744	10.0	Chenango gravelly loam	3,776	1.0
Culvers stony silt loam	27,520	6.9	Rock outcrop	3,456	.9
Lordstown silt loam	14,144	6.5	Volusia stony silt loam	3,072	.8
Steep phase	11,840		Allis silt loam	2,496	.6
Ontario silt loam	21,824	5.5	Rough stony land	2,304	.6
Honeoye loam	19,904	5.0	Barbour very fine sandy loam	2,304	.6
Mohawk silt loam	15,680	4.0	Wooster gravelly silt loam	2,240	.6
Lackawanna stony silt loam	11,584	2.9	Genesee silt loam	2,112	.5
Schoharie silty clay	9,856	2.5	Volusia silty clay loam	1,088	.3
Tunkhannock very fine sandy loam	6,336	1.6	Muck	576	.1
			Total	396,800	

ONTARIO SILT LOAM

The Ontario silt loam consists of a brown, heavy silty loam to silt loam, 8 to 10 inches deep, underlain by a light brown to yellow silt loam which grades into a gray or brownish gray loam to silt loam at a depth of 2½ to 3 feet. This type as mapped in Schoharie County lacks the slight reddish cast that is characteristic of the Ontario soils in Oneida and some other counties of New York. Scattered fragments of sandstone, shale, limestone, and crystalline rocks occur on the surface and through the upper part of the soil section, while in the deep subsoil and substratum limestone fragments are rather abundant, and the finer material is slightly calcareous.

The Ontario silt loam occurs as a narrow belt and in detached areas in the northern part of the county. It is found principally in the towns of Sharon, Seward, Carlisle, Cobleskill, and Schoharie. It occupies rolling hills, with only a few slopes that are too steep to cultivate with machinery, and drainage is adequate.

Practically all this type is cleared and under cultivation, but in only a few places is it developed to its full capacity. Hops are the

principal crop, being most extensively grown in the towns of Seward, Cobleskill, and Sharon. Buckwheat is an important crop in the town of Sharon. Other crops are oats, corn, alfalfa, clover, and timothy. Dairying is gradually becoming an important industry on this type. Hops yield 700 pounds, buckwheat 25 to 35 bushels, and oats 35 to 40 bushels per acre. Alfalfa does well, yielding ordinarily 3 tons of hay from two or three cuttings. Ensilage corn yields 10 to 12 tons per acre. Clover yields about 2½ tons and timothy 1 to 1½ tons per acre. Some fertilizer is used for hops and oats.

Good land of this type can be bought for $30 to $50 an acre, while well-improved farms bring $75 to $100 an acre. Probably the best use of this type is for dairying.

HONEOYE STONY LOAM

The Honeoye stony loam consists of a brown stony loam varying in depth from 10 to 24 inches. Where the till is of shallow depth there is very little difference between the soil and subsoil, but where the underlying rock is from 20 to 24 inches below the surface the lower subsoil is usually lighter brown in color. Limestone outcrops are of frequent occurrence, and fragments of limestone, sandstone, and shale are scattered over the surface and through the soil material.

This type occurs in the northern part of the county in association with the other limestone soils. The largest area is located in the vicinity of Sharon Center. The topography is generally flat, conforming to the surface of the underlying formation, but in many places there is a sharp escarpment of limestone separating the two levels. Owing to the shallowness of the soil and the proximity of the underlying rocks to the surface, it is a droughty type and crops usually suffer from lack of moisture. It is partially residual, particularly in the shallower areas, but whether residual or entirely glacial the material is very largely of glacial origin and is quite calcareous.

Most of this type is cleared and utilized for pasture. Some of the areas in which the soil is deepest are cultivated, fair yields of oats, corn, and hay being obtained. No definite prices can be quoted for land of this type.

HONEOYE LOAM

The Honeoye loam consists of a brown to dark brown loam to silty loam, 8 to 12 inches deep, underlain by a light brown to yellowish brown loam to silty loam of a slightly more compact structure. The deep subsoil and substratum consist of a brownish gray to bluish gray, calcareous till in which limestone fragments are abundant. A large percentage of the stone on the surface and through the soil section is limestone. The stones are not sufficiently large or numerous to

1.— TOPOGRAPHY AND BUILDINGS ON FARMS IN THE REGION OF ONTARIO AND HONEOYE SOILS

2.— MOHAWK SOILS IN THE FOREGROUND; VOLUSIA ON THE HIGHER HILLS

1.— LORDSTOWN SOILS IN THE FOREGROUND; LACKAWANNA SOILS ON THE HILLTOPS

2.— FARMS ON SOILS OF THE LORDSTOWN SERIES

interfere with cultivation. There are included with this type, on account of their small size, a number of areas of silt loam and silty clay loam, the former occurring along the Cobleskill Valley and the latter immediately west of Cobleskill. This heavier soil requires more care in handling than the loam, as it will clod if plowed too wet.

The Honeoye loam is not of large extent, occurring mainly in the limestone belt through the northern part of the county. It is most typically developed in the towns of Sharon, Cobleskill, Schoharie, and Wright. For the most part the type occupies rounded hills with gentle slopes, though in a few places the topography is steep. Drainage is excellent and in some places excessive.

This is one of the best developed soils in the county. Clover, timothy, alfalfa, oats, corn, and hops are the principal crops. A considerable acreage is devoted to buckwheat in the town of Sharon. There are some excellent dairies on this type. In the northern part of the limestone belt, however, especially in the town of Sharon, the scarcity of water is a hindrance to dairying, and conditions are not so prosperous as in the Cobleskill Valley.

Clover yields from 2 to 2½ tons of hay per acre and timothy following clover from 1 to 2 tons. Alfalfa, which is a comparatively new crop in this region, does well. Oats yield 35 to 45 bushels, buckwheat 25 to 35 bushels, and corn for ensilage about 10 tons per acre. Hops yield ordinarily about 725 pounds per acre.

Crop rotations are usually practiced on this type. Modern machinery is used and tillage is thorough. Commercial fertilizers are used for hops and oats, and many farmers top-dress their mowing land. Although this soil is naturally calcareous, the use of ground limestone has proved beneficial on many farms.

Improvements on this type are modern, and the buildings and fences are in good repair. Land values vary according to location, farms in the town of Sharon bringing $35 to $50 an acre, while those along the Cobleskill Valley bring from $50 to $100 an acre.

The extension of dairying and the production of alfalfa, as well as a more general use of some form of lime, are recommended for this soil.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Honeoye loam are given:

Mechanical analyses of Honeoye loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162207	Soil	2.0	3.0	2.2	14.0	17.7	44.5	16.5
162208	Subsoil	1.4	2.8	2.2	14.8	21.1	38.7	18.8

MOHAWK SILT LOAM

The surface soil of the Mohawk silt loam is a brown to dark grayish brown, mellow silt loam, from 8 to 12 inches deep, with an average depth of 9 inches. The subsoil is a grayish brown, compact silt loam, changing at a depth of 15 to 18 inches to a darker gray silt loam carrying a large percentage of black shale chips. The lower subsoil and substratum are moderately calcareous. In places a small quantity of black shale chips is scattered over the surface and through the upper part of the soil section, but the predominant rock fragments are light-colored sandstone, except in areas bordering the Honeoye types, where there may also be some limestone.

There are included with this type a few areas of clay loam too small to show on a map of the scale used. About 2½ miles north of Lawyersville an area occurs in which the surface soil is lighter than that of the typical Mohawk silt loam, and the subsoil is mottled and contains only a few fragments of black shale. In the northern part of the town of Sharon a variation occurs in which the surface soil is a light brown to yellowish brown silt loam about 6 inches deep, underlain by a mottled gray and yellow silt loam, becoming dark gray or grayish yellow at a depth of about 18 inches. The lower subsoil contains scattered fragments of the black Utica shale and in places grades into a silty clay. This variation owes its formation to the action of glacial ice, which spread a mantle of the lighter colored shales and sandstone material over the dark-colored till.

The Mohawk silt loam has its typical development in the northwestern part of the county, mainly in the towns of Seward and Sharon. The topography is rolling, and drainage is generally adequate. The surface permits the use of all kinds of farm machinery.

This type is especially well adapted to dairying, which is fast becoming the chief industry. Hops, which were formerly an important crop are now grown to only a small extent. Oats, buckwheat, clover, and timothy are also grown, timothy to a very small extent. The lighter-colored areas are used principally for the production of oats, buckwheat, and hops, the yields and general agricultural conditions being better than on the Volusia silt loam. At the present time hops and milk are the only farm products sold.

Oats yield 30 to 45 bushels and buckwheat 25 to 30 bushels per acre. Clover does exceptionally well, yielding 2 to 3 tons per acre. Hops yield from 650 to 725 pounds per acre.

Deep plowing, careful cultivation, and crop rotation are usually practiced. Mowing land is usually left in grass three or four years then plowed for corn, which is followed by oats, after which the land is reseeded to grass.

This type embraces some of the best farming land in the county. Good farms can be bought for $35 an acre, although the average price of land is nearer $45.

An extension of dairying, the growing of alfalfa, and the use of lime are recommended for this soil.

VOLUSIA STONY SILT LOAM

The surface soil of the Volusia stony silt loam is a pale yellow to grayish brown silt loam, with an average depth of 8 inches. The subsoil, which extends to a depth of about 36 inches, is a yellowish gray, compact silt loam, with gray, brown, and yellow mottlings. Both the surface soil and subsoil contain an abundance of angular sandstone fragments ranging in size from small cobbles to blocks 3 feet square.

The Volusia stony silt loam occurs throughout the county in small, widely scattered areas. The largest areas occur near Boucks Falls and northwest of Sloansville. The type occupies depressed areas or slopes where the underlying rock formations are not at great depth. Drainage is poor.

This type formerly was heavily forested with white pine, maple, hemlock, and beech, but most of the timber has been removed. The land is farmed only in a desultory manner, supporting a few dairy cows and sheep and producing a little hay of inferior quality. It can best be utilized for pasturage or forestry.

VOLUSIA SILT LOAM

The Volusia silt loam consists of a brownish gray silt loam, 6 to 8 inches deep, underlain by a pale yellowish to gray silt loam, which changes within a few inches to a gray, yellow, and brown mottled, compact silt loam to heavy silt loam. Usually bedrock is not encountered within 3 feet of the surface, and in places the till has considerable depth. Small, angular fragments of sandstone are scattered throughout the entire soil section, but usually not in sufficient quantity to interfere with cultivation. Near the towns of Howes Cave, Grovenor Corners, Carlisle, and Barton Hill there are several small areas in which the limestone formation is encountered at depths ranging from 3 to 10 feet. As in the typical development, however, the soil-forming material is almost entirely derived from shales and sandstones and is not at all calcareous. Small depressions, seldom more than 10 by 20 feet in size, are characteristic of this variation.

Areas of the Volusia silt loam occur in every town in the county, with the exception of Broome and Conesville in the southeastern part. Probably its most typical development is in the towns of Carlisle, Esperance, Schoharie, and Wright. Throughout the southern

part of the county this type occurs around the heads of streams or in partially depressed areas. The topography is undulating to gently rolling (see Plate VIII, 1 and 2). The heavy, compact structure of the subsoil, together with the lack of natural drainage, renders this a cold soil and interferes with crop growth.

This type is not important agriculturally. Many of the farms are held in tracts of 600 to 700 acres. On most of the farms only a small area is under cultivation, while in many cases the fields are not even mowed for hay or used for pasturage. Some farms are deserted. The fences and buildings are generally in poor condition, and in many places the former have been entirely removed. Most of the original forest growth, which consisted of sugar maple, white pine, beech, and hemlock, has been removed, and at present golden rod, daisies, sorrel, and devils paintbrush abound in the pastures, old fields, and fence corners of cultivated fields.

The principal crops are timothy hay, oats, buckwheat, corn, and potatoes. At present timothy hay is the most important crop. It is usually baled and hauled to the nearest railroad station for shipment. Very little clover is grown, although excellent stands of red clover have been obtained with the use of lime. Nearly every farmer produces some oats for feeding stock. Potatoes are not extensively grown, as the product is of poor quality. Dairying is carried on in a desultory manner. As a rule a few cows of mixed breeds are kept, and the returns are correspondingly low. Some of the more progressive farmers, however, have good cows, usually Holstein. Where the farms are close enough to a railroad the raw milk is shipped, otherwise it is sent to the creamery or made into butter on the farm.

On some of the better farms yields of 1 to 1½ tons of timothy hay to the acre are obtained, but on most farms only about one-half to three-fourths of a ton per acre is obtained. Oats yield 20 to 30 and buckwheat 25 to 35 bushels per acre. Owing to the short growing season and the poor drainage, very little corn is matured. It is grown mostly for fodder.

The agricultural methods followed by most of the farmers on this type are among the poorest in the county. There are but few silos, and crop rotations are seldom practiced. Fields are allowed to stand until the grass is too light to cut, when buckwheat or corn is grown one year, followed by oats, and then by grass. The soil is plowed only about 3 to 5 inches deep, and no manure is used. Tenants usually sell off practically all the hay and straw instead of keeping stock and feeding the roughage. A small quantity of commercial fertilizer is sometimes used with oats.

Land values vary with location and improvements. Thousands of acres in a more or less run down condition can be purchased at $6 to

$15 an acre. Farms with fair buildings are held at $10 to $18 an acre. The average price of land is less than $15 an acre.

This type is best suited to dairying and the raising of live stock, especially sheep and poultry. All the manure should be returned to the soil, and some form of lime should be used. Most of the type requires artificial drainage for profitable production of crops.

VOLUSIA SILTY CLAY LOAM

The surface soil of the Volusia silty clay loam is a light grayish brown loam to silty clay loam, about 8 inches deep, sometimes containing gray and brown mottlings in the lower part. The subsoil to a depth of about 36 inches is a light yellow to gray silty clay loam, heavily mottled with yellow, orange, and brown. In many places the subsoil below 24 inches consists of a clay or silty clay and may carry a few dark-colored shale fragments, in this respect resembling the lower subsoils of the Mohawk series. There is usually a small quantity of light-colored, angular fragments of shale and sandstone strewn over the surface.

This type is of small extent, occurring mainly in the town of Seward. The topography is gently rolling to nearly level, and the natural drainage is poor.

General farm crops as well as some hops are grown. The yields are about the same as on the Volusia silt loam. Grass does well where properly drained. Land values vary according to the improvements, usually ranging from $15 to $30 an acre.

In the following table the results of mechanical analyses of samples of the soil and subsoil of this type are given:

Mechanical analyses of Volusia silty clay loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162231	Soil	0.4	1.5	1.1	5.2	4.1	52.4	35.1
162232	Subsoil	1.0	1.3	.8	4.0	4.2	46.0	42.4

ALLIS SILT LOAM

The Allis silt loam to an average depth of 8 inches is a light gray to grayish yellow, friable silt loam, underlain by a gray to brownish gray silt loam, mottled with brown, yellow, and orange. The entire soil section contains a large percentage of small, shaly sandstone fragments. The type is shallow, ranging in depth from a few inches to about 20 inches, and narrow ledges and ridges of the underlying sandstone formation outcrop in many places, interfering with cultivation.

Near Howes Cave, Carlisle, Carlisle Center, Grovenor Corners, and Sloansville there is a variation of this type in which the sandstone and shale material overlies limestone, which is encountered at a depth of 8 to 20 inches.

The soil material in these areas was undoubtedly transported by the glacier in one of its east to west movements.

Where typically developed, the Allis silt loam occupies the tops of the higher elevations and the slopes of ridges. The largest area is encountered north of Esperance. Other bodies occur near Central Bridge, and 3 miles north of Gallupville. Drainage is unsatisfactory, seepage from the joint planes and crevices of the underlying ledges making the soil too wet during the spring season, while the shallowness of the soil causes it to be droughty in the summer.

Only a small proportion of this type is under cultivation. Buckwheat, oats, and hay are the principal crops. Only fair yields are obtained. A large proportion of the type is used for pasturing cattle and sheep. A forest growth of beech, maple, and hemlock usually covers the steepest slopes.

Very little of this type is changing hands at present. Land values are low, and the type can best be utilized for forestry.

Mechanical analyses of samples of the soil and subsoil of the Allis silt loam are given in the following table:

Mechanical analyses of Allis silt loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162213	Soil	1.7	3.0	1.4	8.5	16.2	49.7	19.5
162214	Subsoil	2.7	3.4	1.7	11.7	19.3	43.4	17.5

LORDSTOWN STONY SILT LOAM

The Lordstown stony silt loam consists of a light brown to yellow, mellow silt loam, 5 to 8 inches deep, underlain by a yellow to light yellow, friable silt loam, which rests upon bedrock at a depth of 12 to 36 inches. The surface is thickly strewn with shaly sandstone fragments ranging in size from small cobbles to bowlders 3 feet or more in diameter. While the rock fragments are for the most part of local derivation, foreign rocks, such as gneiss, schist, granite, and quartzite, are often encountered. In many places the underlying shaly sandstone formation outcrops in the form of narrow ridges or ledges or lies just below the surface. Scattered throughout this type are a number of low-lying, poorly drained areas that would have been mapped in the Volusia series had they been of sufficient size.

The Lordstown stony silt loam is the most extensive soil type in the county. It occurs on the uplands in the towns of Seward, Cobleskill, Esperance, Schoharie, Wright, Middleburg, Fulton, Richmondville, Summit, Jefferson, Blenheim, Gilboa, and Broome. The topography is rolling to hilly and drainage is good.

Owing mainly to the distance from railroads, the elevation, and the high stone content, this type is not valued highly for agriculture. The early settlers established many farms upon it, but a large number of these have been abandoned and allowed to deteriorate.

Dairying is the principal industry on this type (see Plate IX, 1 and 2). Some farmers raise poultry on a commercial scale. A few sheep are kept. Enough hay is produced to feed the stock and any surplus is sold. Only a small acreage is devoted to the production of corn. Oats, buckwheat, and potatoes are grown mainly for home consumption.

Hay crops yield one-half to one and one-half tons, oats 25 to 35 bushels, buckwheat 15 to 20 bushels, and potatoes 75 bushels per acre. Very little commercial fertilizer is applied to any of these crops, and in many cases the barnyard manure is not utilized.

The price of land of this type ranges from $6 to $25 an acre, depending upon the condition of the soil and the character of the improvements. It seldom changes hands.

The Lordstown stony silt loam is best suited to dairying or stock raising. The raising of sheep for wool and mutton should be extended. The rougher and stonier areas should be reforested.

Lordstown stony silt loam, steep phase.—The Lordstown stony silt loam, steep phase, does not differ materially from the main type. It usually consists of 4 to 6 inches of a yellow to dark yellow silt loam, underlain by a somewhat lighter colored, friable silt loam. A large number of angular fragments of shaly sandstone are scattered over the surface and throughout the soil section. These are numerous enough to interfere with cultivation. The underlying rock formations are close to the surface and often protrude.

This phase is mapped along the valleys throughout the southern part of the county, occupying steep hillsides which in places attain an elevation of 700 feet in half a mile. It is separated on the basis of topography, and the boundaries are therefore more or less arbitrary.

Most of this steep phase is utilized for pasturage or forestry. A part of it supports a second growth of hemlock, beech, and maple. Some small patches are used for the production of the general farm crops of the region, and fairly good yields are obtained. Land values are low.

This phase, because of its stony character and steep topography, should never have been cleared. Cultivated fields should be reforested or seeded to grass and used for permanent pasture, and forested areas should receive careful attention.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Lordstown stony silt loam:

Mechanical analyses of Lordstown stony silt loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162241	Soil	1.6	2.6	1.1	5.9	15.1	52.5	21.0
162243	Subsoil	4.1	4.7	1.7	7.9	19.0	46.0	16.3

LORDSTOWN SILT LOAM

The surface soil of the Lordstown silt loam is a light brown to yellow, friable silt loam from 6 to 8 inches deep. The subsoil consists of a light yellow to slightly grayish yellow, friable silt loam. Both the soil and subsoil contain small, angular fragments of shaly sandstone. Bedrock, consisting of gray sandstones and sandy shales, is encountered at a depth of 2½ to 6 feet.

This type is most extensively developed in the western part of the county, with smaller areas scattered throughout the uplands in the southern part. It is typically developed in the towns of Summit, Richmondville, Seward, and Cobleskill. The topography is gently sloping to rolling, and both surface drainage and underdrainage are well established. Some of the more shallow areas suffer from drought during the summer months.

Most of this type has been cleared and is under cultivation. A small percentage of it has been allowed to deteriorate and is not of much value for agriculture. The soil is well adapted to the general farm crops of the region. Buckwheat, oats, and hay are the principal crops. Yields are fair. Very little commercial fertilizer is used. Land values range from $8 to $45 an acre, depending mainly upon location.

This type of soil is well adapted to potato growing and is utilized for that purpose throughout the potato region of southern New York. At present the meadows are left down too long. Rotation should be more generally practiced. The utilization of all stable manure, together with applications of limestone, can not be too strongly urged.

Lordstown silt loam, steep phase.—The Lordstown silt loam, steep phase, consists of a light brown to yellowish brown silt loam, 4 to 6

1.— SCENE ON THE VOLUSIA SILT LOAM

2.— TOPOGRAPHY AND BUILDINGS ON VOLUSIA SILT LOAM

1.— PASTURE ON THE LORDSTOWN STONY SILT LOAM. DAIRYING IS THE PRINCIPAL INDUSTRY ON THIS TYPE

2.— BUILDINGS ON A DAIRY FARM IN THE REGION OF LORDSTOWN SOILS

inches deep, underlain by a yellow to pale yellow, friable silt loam. Both soil and subsoil carry a few small, angular sandstone fragments, and bedrock usually is encountered within 2 or 3 feet of the surface.

This phase is developed principally in the towns of Seward, Cobleskill, Middleburg, and Richmondville. It occupies hillsides that are too steep for profitable cultivation and is well drained.

A part of this phase is under cultivation, but most of it is utilized for pasturage or woodland. It should never have been entirely cleared. Land values are low.

WOOSTER GRAVELLY SILT LOAM

The Wooster gravelly silt loam consists of a light brown to yellow, mellow silt loam, 6 to 10 inches deep, underlain by a yellow to light yellow, friable silt loam, which extends to a depth of 3 feet or more or gives way at about 2 to 3 feet to a loam or gravelly layer. The soil and subsoil contain varying quantities of waterworn gravel and angular fragments of sandstone, and the substratum is very gravelly or stony. The stone and gravel are usually of small size and do not interfere seriously with cultivation. A few small bodies of stratified kame and esker formation and others, consisting of reddish morainic material similar to that of the Lackawanna soils in the southern part of the county, are included with this type.

The Wooster gravelly silt loam occurs principally in the towns of Richmondville and Summit, with smaller areas through the southern part of the county. The material consists of morainic deposits along the heads of the larger valleys or streams. The natural drainage is adequate.

This soil is farmed in connection with the adjacent types, and similar yields are obtained. Potatoes, corn, and oats do especially well. Commercial fertilizer is used on corn and oats.

CULVERS STONY SILT LOAM

The surface soil of the Culvers stony silt loam is a brown to pinkish brown stony silt loam, 7 to 10 inches deep. The subsoil to a depth of 3 feet or more is a brown to yellowish brown, heavy loam or silt loam, which also has a decidedly pinkish cast. The type carries enough angular fragments of gray and red sandstone to interfere somewhat with cultivation. This type is intermediate between the light brown soils of the Lordstown series, derived largely from gray shales and sandstones, and the Lackawanna soils, which are derived almost entirely from the red Oneonta sandstone.

This type has its principal development in the southeastern part of the county, in the towns of Broome, Conesville, and Gilboa. The topography is rolling to hilly, and drainage is well established.

Agriculture is not well developed on this soil type. Dairying is probably the main industry. Most of the milk is made into butter at home. Some hay is produced for market. Much of the type is in forest or pasture. Farm buildings are in a fair condition of repair. Only a few farms have silos.

Hay crops yield 1 to 1½ tons per acre. Corn yields 8 to 10 tons of silage per acre. Oats yield 25 to 35 bushels, buckwheat 18 to 25 bushels, and potatoes 75 to 100 bushels per acre. Only a small quantity of commercial fertilizer is used. Crop rotations are practiced only in a general way.

Better methods of cultivation, crop rotation, either the raising of sheep or dairying, and the introduction of silos are recommended. Much of the land should be reforested.

Farms range in value from $8 to $30 an acre, depending upon improvements and the proportion of the land under cultivation.

LACKAWANNA STONY SILT LOAM

The Lackawanna stony silt loam consists of a brownish red to bright red, mellow silt loam, 8 to 12 inches deep, underlain by a reddish brown silt loam. Red sandstone fragments are numerous on the surface and through the soil section, seriously interfering with cultivation.

This type is confined to the southern part of the county, the largest areas occurring in the towns of Jefferson and Conesville. The topography varies from rolling to mountainous, and drainage is good.

Owing to the unfavorable topography, only a relatively small proportion of this type is under cultivation, most of it being used for pasturage and forestry. It produces good yields of hay, corn, oats, and buckwheat. Dairying is the most important industry, the milk going to local creameries for shipment to New York City.

Land values vary greatly within short distances and depend upon the agricultural possibilities and condition of the farm improvements.

Probably the best uses of this type are for dairying, sheep raising, and forestry.

SCHOHARIE SILTY CLAY

The Schoharie silty clay consists of a brown to reddish brown silty clay, with an average depth of 9 inches, underlain to a depth of 36 inches or more by a grayish brown to reddish brown, heavy silty clay loam or silty clay, usually thickly mottled with gray and brown. The type as a whole is quite free from rock fragments. In places there are a few inches of till, containing limestone and sandstone fragments overlying the lake-deposited material of which this type

consists, but as the total area of such material is less than 200 acres, it is not shown on the map.

This type occurs along the Schoharie Creek Valley in the towns of Gilboa, Blenheim, Fulton, Middleburg, Schoharie, and Esperance. The topography is nearly level to rolling and broken.

The rolling and broken areas of this type are not well developed agriculturally. Some hay, oats, and buckwheat are grown and a few cows are kept. Only small yields are obtained. On the level areas in the towns of Middleburg and Schoharie, however, agricultural conditions are excellent. Here dairying is the main industry, and hay, oats, and wheat are the principal crops. A little corn is grown for ensilage and hops are grown to a small extent. Hay crops yield 1½ to 2 tons, oats 35 to 45 bushels, and wheat 20 to 40 bushels per acre. Commercial fertilizers are used and crop rotations are generally practiced. Modern machinery is used on nearly every farm. The buildings are in good repair, and the farms show evidences of thrift.

The price of land of this type ranges from $50 to $150 an acre. The land seldom changes hands.

Results of mechanical analyses of samples of the soil and subsoil of the Schoharie silty clay are given in the following table:

Mechanical analyses of Schoharie silty clay

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162201	Soil	0.1	0.9	0.7	3.7	3.4	51.0	40.0
162202	Subsoil	.0	.3	.3	1.0	0.7	47.6	50.0

CHENANGO GRAVELLY LOAM

The Chenango gravelly loam consists of a brown gravelly loam, 8 to 12 inches deep, underlain by a yellowish brown to yellow gravelly loam, which extends to a depth of 3 feet or more. The lower part of the subsoil is usually coarser in texture than the upper part, and in many places it consists of stratified gravel or coarse sand. The gravel includes both waterworn and subangular fragments of light-colored sandstone and shale. It seldom occurs in quantities sufficient to interfere with cultivation. There are included with this type a few areas having a darker color and in which the predominating gravel consists of limestone. Such areas would have been mapped as the Fox gravelly loam had they been of sufficient size. Near the village of Dorloo there is an included area of silt loam about 200 acres in extent. Here the surface soil consists of a brown to grayish brown silt loam, about 9 inches deep, underlain

by a yellow silt loam containing gray and brown mottlings, and extending to a depth of about 22 inches, where a stratum of fine to medium sand is encountered.

The Chenango gravelly loam is most extensively developed along Cobleskill and Schoharie Creeks. The largest areas are found near Middleburg and northeast of Richmondville. Smaller areas occur throughout the larger valleys in the uplands. The type occupies level to undulating terrace areas and is well drained.

Nearly all the Chenango gravelly loam is under cultivation, as it is recognized as one of the best soils in the county. Corn is grown both for silage and for grain and yields an average of 12 tons of the former and 35 to 70 bushels of the latter per acre. Oats yield from 35 to 65 bushels and hops 600 to 700 pounds per acre. Mixed hay crops yield 1½ to 2 tons per acre. A few good stands of alfalfa have been obtained on this soil type.

Good cultural methods are employed, and both stable manure and commercial fertilizer are used. Farm buildings are above the average. Land values range from $75 to $150 an acre.

TUNKHANNOCK VERY FINE SANDY LOAM

The Tunkhannock very fine sandy loam consists of a brown to reddish brown very fine sandy loam, 8 to 12 inches deep, underlain by a brown to reddish brown fine sandy loam to very fine sandy loam, which extends to a depth of 3 feet or more. On the larger flats near Schoharie the soil approaches a silty fine sandy loam and even a silt loam in texture.

The Tunkhannock very fine sandy loam occurs along Schoharie Creek in the towns of Gilboa, Blenheim, Fulton, Middleburg, Schoharie, and Esperance. In the last-named town the material lacks the pronounced reddish color that is exhibited to the southward. The type occupies low-lying, level terraces along Schoharie Creek, where the material is largely from the red shales and sandstones of the Catskill Mountains. It lies above normal overflow and is well drained, except in unusually wet seasons.

The Tunkhannock very fine sandy loam is well developed agriculturally. Wheat, oats, hay, and hops are the principal crops. In the vicinity of Schoharie there are several large fruit nurseries. Wheat yields 20 to 35 bushels and oats 45 to 60 bushels per acre. Hay crops do well, considering the texture of the soil, mixed clover and timothy yielding 1½ to 2 tons per acre. Some exceptionally fine hop yards are located on this type and yields of 650 to 750 pounds per acre are obtained. The farmers have modern implements and practice good cultural methods. The farm buildings are in excellent condition.

Land values are high, especially for this section of the State, farms being held at $125 to $200 an acre.

A number of areas of Tunkhannock gravelly loam occurring in association with the Tunkhannock very fine sandy loam, mainly in the towns of Gilboa and Conesville, are included with the latter type and are indicated by gravel symbols on account of their small extent. The surface soil of the Tunkhannock gravelly loam consists of a dark-brown to dark reddish brown gravelly very fine sandy loam to silty loam, and the subsoil of a red to reddish brown gravelly very fine sandy loam to loam. Stratified gravel usually occurs at a depth of 24 to 30 inches, but the particles are generally of small size and do not interfere with cultivation. These included areas are utilized for general farm crops. Corn does well and is grown both for grain and ensilage. Some oats and hay are also grown and fair yields are obtained.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Tunkhannock very fine sandy loam are given:

Mechanical analyses of Tunkhannock very fine sandy loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162205	Soil	0.0	0.2	0.3	14.3	25.6	47.0	12.5
162206	Subsoil	.0	.0	.3	22.1	29.2	37.8	10.6

GENESEE SILT LOAM

The surface soil of the Genesee silt loam to an average depth of 10 inches is a brown to dark brown silt loam. This is underlain by a dark brown silt loam, which extends to a depth of 36 inches or more, and is deeply mottled in many places with gray and yellow. The entire soil section is practically free from rock fragments.

Included with this type are a number of small areas of Genesee gravelly loam, having a brown to dark brown, gravelly loam surface soil, about 10 inches deep, and a somewhat lighter colored subsoil of similar texture. The gravels consist of light-colored shales and sandstones, with occasionally some limestone. They are not plentiful enough to interfere with cultivation.

The largest area of the Genesee silt loam occurs along Cobleskill Creek near the village of Cobleskill. Smaller areas are encountered in first-bottom positions throughout the county. Usually the natural drainage is deficient.

Where well drained this soil is suited to the production of general farm crops and to pasturage. Its agricultural value depends pri-

marily upon drainage conditions. It is utilized mainly as mowing and pasture lands.

BARBOUR VERY FINE SANDY LOAM

The surface soil of the Barbour very fine sandy loam is a dark brown to reddish brown, mellow very fine sandy loam, 8 to 12 inches deep. The subsoil is slightly lighter in color and of similar texture. In places the type contains a small quantity of waterworn fragments of sandstone and shale.

The Barbour very fine sandy loam occurs only in the eastern and southeastern parts of the county along the Schoharie Creek and its tributaries, and is subject to overflows. The topography is level to nearly level and the drainage is usually deficient.

Only a few of the larger and better drained areas are under cultivation, and these are devoted to general farm crops. Where sufficiently well drained this soil produces good yields of corn, oats, and hay.

In the following table the results of mechanical analyses of samples of the soil and subsoil of the Barbour very fine sandy loam are given:

Mechanical analyses of Barbour very fine sandy loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162203	Soil	0.0	0.1	0.1	12.8	39.1	40.5	7.2
162204	Subsoil	.0	.0	.3	16.6	39.1	36.4	7.6

ROCK OUTCROP

Rock outcrop comprises areas in which the bedrock is either completely exposed or has such a thin covering of soil as to be incapable of supporting anything but a scant growth of scrub timber and briers. Such areas usually occur as steep slopes and ledges, the rocks on the slopes consisting of shale and sandstone, while the ledges are of limestone.

ROUGH STONY LAND

Rough stony land includes areas that are too rough and stony for cultivation. There are a few patches of arable land occurring within the areas of Rough stony land, but these are too small to indicate on the map. This type is encountered mainly within the region occupied by the Culvers and Lackawanna soils in the towns of Conesville, Gilboa, and Jefferson. In places it affords a little pasturage, but the greater part of it is forested with a scattered growth of hemlock, maple, beech, and pine. The value of Rough

stony land depends upon the quality and quantity of the forest growth. Its best use is for forestry.

MUCK

The surface soil of Muck consists of an accumulation of dark brown to black decomposed vegetable matter mixed with fine particles of soil washed from higher lying areas. It varies in depth from 12 inches to several feet. The subsoil is usually a blue or mottled gray and drab plastic sandy clay.

The largest areas of Muck are encountered in the towns of Sharon and Carlisle, while smaller areas are widely scattered throughout the uplands. All the areas occupy low-lying positions and are naturally poorly drained. Most of this type supports a growth of cedar, hemlock, and elm, as well as water-loving plants and bushes. None of it is under cultivation. A few of the larger areas might be reclaimed by drainage. Values are based on the quantity and quality of the standing timber, the larger tracts usually bringing about $10 an acre.

MEADOW

The term Meadow is applied to poorly drained areas not suitable for cultivation or for any use other than pasturage. The surface soil is usually dark colored, while the subsoil is mottled gray, brown, and yellow. The texture of the soil varies widely even within a few feet.

Meadow occurs in small, scattered areas throughout the county. It is usually encountered along streams, and is low, wet, and swampy. A few areas are too small to show on a map of the scale used.

SUMMARY

Schoharie County is situated in the eastern part of New York. It has an area of 620 square miles, or 396,800 acres.

The topographic features are the rolling uplands in the northern part of the county and the rugged mountainous section in the southern part. Elevations range from 600 to 3,200 feet above sea level.

The summers are mild and pleasant, while the winters are long and cold. The growing season is long enough to mature most of the crops grown in this region and the rainfall is abundant and evenly distributed.

Schoharie County was settled early in the eighteenth century. The population of the county decreased from 32,910 in 1880 to 23,855 in 1910. About 75 per cent of the population is rural and the density of the rural population is 37.2 persons per square mile.

At present dairying is the most important industry, the chief products being raw milk and butter. The principal farm crops are hay and forage, oats, and buckwheat. Other important crops are corn, rye, wheat, barley, potatoes, and hops.

Approximately 90 per cent of the total area of the county is in farms, and of this 69 per cent is improved. There are 2,495 farms, of an average size of 112,9 acres. Nearly 76 per cent of the farms are operated by owners and nearly 23 per cent by tenants. The adaptation of soils to crops is recognized only in a general way. Commercial fertilizers are used to some extent. Much of the land under cultivation is too rough for the use of machinery.

The soils of the county are divided into three groups, based on origin, character of material, and method of formation. These are ice-laid soils, stream terrace and lake-laid soils, and alluvial soils. In all, 14 series of soils, embracing 18 distinct types, in addition to areas of Muck, Meadow, Rough stony land, and Rock outcrop, are mapped. The glacial-till soils occupy the uplands and are the most extensive and important soils in the county. The topography of these soils ranges from hilly to mountainous, and drainage is good.

The Ontario series is represented by one type, the silt loam. This soil is composed of calcareous till from light-colored shales and sandstones, with a small proportion of limestone. It is a productive soil. Hops, oats, and buckwheat are the principal crops, and dairying is an important industry. Good farms on this type sell for $50 an acre.

The Honeoye series comprises the highly calcareous soils of the limestone belt in the northern part of the county. This series is represented by two types, the stony loam and loam. Agricultural conditions on these types are among the best in the county. Good yields of clover and timothy hay and alfalfa are obtained. Hops, oats, and corn also do well. Dairying is an important industry. Land values range from $35 to $100 an acre.

The Mohawk series is represented by one type, the silt loam, having a brown to dark brown surface soil and a grayish brown to dark brownish gray, slightly calcareous subsoil. The principal crops are hops, clover, oats, and buckwheat. Dairying is carried on and is increasing in importance. Land values are relatively low, considering the productiveness of the soil.

The Volusia series is represented in Schoharie County by three types, the stony silt loam, silt loam, and silty clay loam. The material forming these soils is derived from light-colored shales and sandstones. The soils are poorly drained and mottled and have a low value.

The surface soils of the Allis silt loam is light gray to grayish and yellow, and the subsoil is gray to brownish gray, mottled with brown,

yellow, and orange. This is a poorly drained soil and only a small proportion if it is under cultivation. Buckwheat, oats, and hay are the principal crops. Only fair yields are obtained.

The Lordstown is the most extensively developed series in the county. The surface soils are light brown to yellowish brown and the subsoils are yellow to grayish yellow. The abandoned and run-down farms of southern New York are located on these soils. This series is represented by two types, the silt loam and stony silt loam, each with a steep phase. These types are best suited to dairying or sheep raising.

The Wooster gravelly silt loam is a light-colored, well-drained soil. It is inextensive and is farmed in connection with other types. Potatoes, corn, and oats do well.

The Culvers stony silt loam has a brown to pinkish brown surface soil and a brown to yellowish brown, heavy loam or silt loam subsoil with a decidedly pinkish cast. Agricultural conditions are poor on this type. Dairying is the principal industry. Some hay is produced for market. Much of the type is in forest or pasture.

The surface soil of the Lackawanna stony silt loam is brownish red and the subsoil is somewhat lighter in color. The topography is rolling to hilly and mountainous. Only a small proportion of the type is under cultivation. It is devoted mainly to pasturage and forestry.

The surface soil of the Schoharie silty clay is brown to reddish brown and the subsoil is grayish brown to reddish brown, with gray and brown mottlings. The topography ranges from nearly level to rolling and broken. On the more level areas agricultural conditions are excellent. Dairying is the main industry, and hay, oats, and wheat are the principal crops.

The Chenango gravelly loam has a brown surface soil and a yellowish brown to yellow subsoil. This type, though inextensive, is one of the best soils in the county and is fairly well developed. Corn, oats, and hay are the principal crops.

The Tunkhannock series is represented by one type, the very fine sandy loam. This is a brown to reddish brown, low-lying, level terrace soil occurring along Schoharie Creek. It lies above normal overflow and is usually well drained. Good yields of wheat, oats, hay, and hops are obtained. Land values are relatively high.

The first-bottom soils subject to overflow are represented by the Barbour very fine sandy loam and the Genesee silt loam, which are of small extent and relatively unimportant.

Muck consists of an accumulation of dark brown to black decomposed vegetable matter mixed with fine particles of soil washed from higher lying areas. None of it is under cultivation, owing to its undrained condition.

The term Meadow is applied to poorly drained areas not suitable for any agricultural use other than pasturage. Small scattered areas of Meadow occur throughout the county.

Rock outcrop represents rock exposures which in places have a sufficient covering of soil to support a scant growth of scrub trees and briers.

Rough stony land includes areas that are too rough and stony for cultivation but afford a little pasturage.

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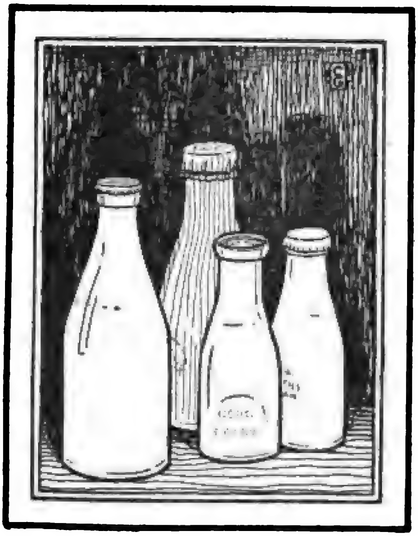
What is Meant by "Quality" in Milk

W. A. Stocking, H. A. Harding, R. S. Breed, and E. G. Hastings



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FOREWORD

For many years the Official Dairy Instructors Association, which has recently become the American Dairy Science Association, has maintained a committee on dairy score card, which committee is responsible for the so-called " official " dairy score card. In 1912 this committee recognized the necessity for a different score card evaluating the quality of milk rather than the conditions under which milk was produced, and formed a subcommittee to study this problem. This subcommittee was later made an Association committee on milk quality. Extensive investigations have been conducted, particularly at the New York Agricultural Experiment Station and the Illinois Agricultural Experiment Station, at Urbana, in connection with this study, and the present publication is an analysis of the problem of milk quality as it appears to this committee after these years of study.

H. A. Harding,
College of Agriculture and Agricultural Experiment Station, University of Illinois.

R. S. Breed,
New York Agricultural Experiment Station, Geneva.

W. A. Stocking,
New York State College of Agriculture and Agricultural Experiment Station at Cornell University.

E. G. Hastings,
College of Agriculture and Agricultural Experiment Station, University of Wisconsin.

WHAT IS MEANT BY "QUALITY" IN MILK

W. A. STOCKING, R. S. BREED, H. A. HARDING,
AND E. G. HASTINGS.

INTRODUCTION

Milk is often called good or bad, but it is difficult to define either quality. It needs but a slight study of the milk question to recognize that the goodness or badness of milk depends upon several factors. Because of the complexity of this situation there is much confusion in the public thought regarding quality in milk. As a result, milk is still commonly sold without the use of grades to designate quality, the State of New York being one of the few exceptions to this rule.

The present publication is a brief summary of previous considerations of the various sides of this question, a plea for a broader consideration of the problem of milk quality, and a suggestion regarding the line along which future progress in the improvement of city milk supplies will undoubtedly be made.

ELEMENTS OF QUALITY IN CITY MILK

Many factors combine to determine the quality of milk. Each of the factors has been recognized as important at one time or another, but apparently thus far no one has succeeded in so fully analyzing the city milk situation as to formulate a complete expression for milk quality. The following summary[1] of the elements of quality in city milk under the headings of food value, healthfulness, cleanliness, and keeping quality is an attempt at such an analysis. The order of presentation of these elements is essentially that in which they have been previously brought to public attention.

FOOD VALUE

While milk is sometimes used as a beverage, the fundamental reason for the existence of the present vast traffic in milk is the fact that milk is one of our most important foods. Not only does it offer

[1] This summary of elements of quality in city milk does not consider the occasional occurrence in milk of disagreeable substances, of which onions and gasoline are the most common examples, because the evident presence of such substances automatically excludes such milk from the cit~ trade.

energy in a readily available form, but the amount and variety of the compounds contained in milk make it a peculiarly valuable food for growing children. The present consumption of milk in this country is only about 0.6 pint per capita per day, altho from the standpoint of protein, which is especially needed by the growing child, or from the standpoint of total energy as utilized by the adult, much more food value is obtainable from milk for a given sum of money than can be purchased in any comparable food. The high food value of milk is shown by the following table recently prepared by the U. S. Department of Agriculture:

PROTEIN	ENERGY
1 quart of milk is equal to:	1 quart of milk is equal to:
7 ounces of sirloin steak	11 ounces of sirloin steak
6 ounces of round steak	12 ounces of round steak
4.3 eggs	8½ eggs
8.5 ounces of fowl	10.7 ounces of fowl

In 1856 the laws of Massachusetts[2] attempted to protect milk from adulteration and since that time federal, state, and municipal authorities have enacted laws establishing standards for butter fat and the other solids in milk. It was the original conception that milk is of essentially fixed composition and that the establishment of minimum standards would stop the watering and skimming of milk. The establishment of these legal standards undoubtedly has had a pronounced effect in limiting open and gross adulteration of milk, but the secondary and unexpected effects of such enactments have been such as to raise the question whether, taken as a whole, they have been beneficial to the quality of the milk supply.

While it is true that these legal standards set definite limits to the extent to which the food value of milk could be reduced without incurring the penalty of the law, at the same time they offered indirectly a stimulus for the reduction of such food value to a figure approximating these legal minimum standards.

The cost of producing milk at the farm is fairly proportional to the amount of food value in the milk. With the narrow margin of profit which exists in milk production, there has been a strong impelling force toward the production of milk with the smallest food value that the market would accept without reduction in price. When the law prohibited the reduction of food value by the direct addition of water, the same result was frequently accomplished by the selection

[2] Parker, H. N. City Milk Supply, p. 370. 1917.

of animals producing milk which approached or even fell below the legal minimum limits. It is a matter of common knowledge that the milk supplies of our larger cities have been falling in food value, and today much of the milk sold in such cities is almost exactly at the legal limit of fat and below the legal limit in solids not fat.

This reduction in food value is all the more striking in view of the marked preference which the consuming public has for milk of high food value. Many progressive milk dealers, recognizing this situation, have offered milk high in fat content at an advanced price with commercial success.

While there is no simple, and at the same time, entirely satisfactory method of expressing the food value of milk, it may be roughly measured in a variety of ways. The housewife customarily judges the food value of milk by noting the depth of the cream line in the milk bottle. The food values of the other constituents of normal milk do not vary in absolute proportion to the fat, and therefore the fat is not an entirely accurate measure of the food value of the milk; but, at the same time, the variations in total food value are so nearly proportional to the variations in the fat of the milk that the fat content of milk of cows may well be used as an index of the relative food value of various samples of milk. This index has the added convenience of being easily and accurately determined by means of the Babcock test.

HEALTHFULNESS

It is not enough that a bottle of milk shall have abundant cream in order to be accurately characterized as good milk. If such milk should contain even a limited number of virulent typhoid-fever organisms, it would be rejected by anyone who was acquainted with this fact. While the milk business is conducted primarily because milk is a valuable food, the occasional appearance of an epidemic spread by the use of milk has made the public suspicious of the healthfulness of all milk. This public suspicion is a severe handicap to the milk business, and any procedure which will remove this suspicion and stimulate the increased consumption of milk will be of great economic benefit to the dairy industry as well as to the consumer.

While the possibility of milk functioning as a carrier of disease had been previously discussed, beginning about 1893[3] the use of the tuberculin test revealed a large amount of tuberculosis in dairy cattle

[3] Pearson, L. A. Proceedings of the First International Veterinary Congress of America. Oct., 1913.

and the public was impressed with the danger of spreading tuberculosis thru the milk.[4] Later investigations, particularly those made during the past fifteen years, have fully demonstrated the danger of tuberculosis being transmitted from cows to children thru the milk. Occasional epidemics[5] of septic sore throat and typhoid fever and less frequently epidemics of scarlet fever and diphtheria transmitted in the same way have given good grounds for suspicion regarding the healthfulness of the ordinary raw milk supply. The amount of danger from this source is commonly overestimated, but its existence, particularly in the case of children, is beyond question and should not be overlooked.

Health authorities, early recognizing tuberculosis of cattle as a public menace, attempted to stamp it out by the widespread application of the tuberculin test. The difficulties encountered in such an attempt made it evident that whatever may be the value of the tuberculin test as such, there is little prospect that the application of the test will become so widespread as to offer protection to the general milk supply.

It has also been recognized that tuberculosis is only one of a number of diseases which may be distributed thru the milk supply. Any plan which is to make milk a safe article of food must take account, not only of diseases which may be transmitted from the cow, but also of the more formidable list of diseases which may be transmitted by the milk from the people who handle it to those who consume it. The history of certified milk has made it evident that a careful medical supervision of both animals and men will reasonably protect the milk from danger of transmitting human diseases, but the expense of such supervision is large.

Pasteurization of milk was early advocated as a means of safeguarding the consumer from the dangers, not only of tuberculosis, but of other transmissible diseases. As with the tuberculin test, so with pasteurization, many practical difficulties were encountered in applying the process to the milk supply.

[4] Park, W. H., and Krumwiede, C. The Relative Importance of the Bovine and Human Types of Tubercle Bacilli in the Different Forms of Tuberculosis. Collected Studies from the Research Laboratories, Department of Health, New York City, 7:88-92. 1913.

[5] Trask, J. W. Milk as a Cause of Epidemics of Typhoid Fever, Scarlet Fever, and Diphtheria. Public Health and Marine Hospital Service of the United States, Hygienic Laboratory Bul. 56, pp. 23-149. 1909.

Kelley, Eugene R. The Quantitative Relationship of Milk-borne Infection in the Transmission of Human Communicable Diseases. Jour. Am. Med. Assoc. 67: 1997-1999. 1916.

The studies of Theobald Smith[6] and of Russell and Hastings[7] which pointed out the practicability of pasteurizing milk at 140° F. for thirty minutes, mark the real beginning of modern successful milk pasteurization. This pasteurization, which both gives the desired protection against disease germs and furnishes a product satisfactory to commercial milk requirements, was the beginning of a widespread general interest in the subject. This interest has grown to the point where the regulations of the largest cities and of some of the smaller cities make such pasteurization of the general milk supply compulsory. In some instances this movement toward pasteurization has even taken the form of state enactment.[8]

It is evident that if the milk supply is to be made so safe as to banish the suspicion of danger from disease germs, which is now a factor limiting the consumption of milk, the milk must either be produced under a careful medical supervision regarding the health of the cows and men or it must be properly pasteurized.

CLEANLINESS

In order to conform to the general opinion of a good milk, it is not sufficient that a milk shall have high food value and shall be free from danger of disease. If at the bottom of the bottle of milk there is a distinct sediment, the purchasing public will uniformly reject the milk as being of poor quality. The public is justly desirous of having a clean food supply, and there is probably no food product regarding which it is more sensitive than milk. The extreme sensitiveness of the public in this matter is due in part to the fact that milk naturally lends itself to careful inspection. The white milk forms a natural background against which any foreign matter stands out with startling distinctness. As a result of these physical conditions the unaided eye is able to detect the presence of foreign matter in milk when it is present in such minute quantities as to practically defy detection by analytical methods. The sensitiveness of this inspection is shown by the fact that it is possible thus to find traces of foreign matter in practically any quart of milk which is critically examined, regardless of the care exercised in its production. In the certified

[6] Smith, Theobald. The Thermal Death-Point of Tubercle Bacilli in Milk and Some Other Fluids. Jour. Exp. Med. 4 : 217-233. 1899.

[7] Russell, H. L., and Hastings, E. G. Thermal Death Point of Tubercle Bacilli under Commercial Conditions. Wis. Agr. Exp. Sta. Ann. Rpt., 17, pp. 147-170. 1900.

[8] California St. Bd. of Health. Special Bul. 13. 1916. Oregon Dairy and Food Bul. 5, p. 2. 1917.

milk from the cleanest dairies in the country which is annually brought together in competition at the National Dairy Show, such foreign matter is evident to the eye in over 80 per ct. of the bottles. On the other hand, the amount of this foreign matter is so slight in all certified milk, and in practically all commercial milk, as to be upon the very margin of detection by analytical methods.

Taking advantage of the sensitiveness of the eye to differences in color, a method called the sediment test[9] has been devised for determining the cleanliness of milk. In applying this sediment test, measured quantities of milk are passed thru cotton and the dirt is observed as a residue upon the white cotton. This test has been quite widely applied in commercial work. While in rare cases the presence of considerable amounts of dirt has been demonstrated, in practically all instances the amount of dirt found in the milk has been slight. When attention has been directed to the presence of any considerable quantities of dirt, the conditions of milk production have been promptly modified so as to bring the milk to a uniformly high standard of cleanliness.

Milk as it is now generally produced and handled is one of our cleanest foods.

KEEPING QUALITY

In order that a milk shall be justly entitled to be called good milk, it is not sufficient that it be high in food value, that it be free from danger of carrying disease, and that it be clean, because if it is sour when delivered to the consumer or sours promptly thereafter, it is unsatisfactory. In the northern states, at least, the delivery of milk once a day is expected to supply the needs of the family for the succeeding twenty-four hours. Accordingly, good milk must remain sweet during that period, and preferably during a longer period, in order to justly entitle it to be called good.

It is possible to estimate the condition of the milk with regard to food value, healthfulness, and cleanliness, by comparatively simple methods. The situation with regard to keeping quality is more complex. Souring is induced by the growth in the milk of minute forms of plant life — bacteria. This plant life attacks the sugar of the milk, using it as a food, and producing acid as a by-product. When the accumulation of this acid amounts to approximately 0.3 per ct., the milk begins to taste sour; and when the accumulation of

[9] Weld, I. C. A Plan for Improving the Quality of Milk and Cream Furnished to New Hampshire Creameries. N. H. Agr. Exp. Sta. Bul. 132. 1907.

acid has reached approximately 0.7 per ct., the milk curdles. The problem of maintaining a satisfactory keeping quality is essentially a problem of restricting the development of germ life. It is possible to meet this problem by preventing the entrance of germs, by destroying them after they enter, or by holding the milk under conditions which will prevent the activity of the germs after they enter.

While the problem of the keeping quality of milk can thus be stated in simple terms, the actual restriction of contamination and of development of germ life is a complex matter. There is still a lack of knowledge regarding the relative importance of the various avenues thru which bacteria gain access to the milk, and this results in a lack of knowledge regarding the most practicable means of preventing their entrance.

In attempting to control keeping quality, various cities have made regulations establishing a maximum number of germs permissible in their milk supplies.[10] These regulations did not attain the desired results, and in many cases the cities further stipulated various conditions which must accompany milk production. The establishment of bacterial standards placed upon the milk producer and the milk dealer the responsibility of translating these standards into terms of dairy processes, while the detailed recommendations formulated by the health authorities are an attempt on their part to make this translation. In practice both these attempts have failed to accomplish the desired end. As a measure of the keeping quality there are many advantages in a direct[11] determination of the germ life, but this is a technical process not readily available to the dairymen and accordingly has certain limitations.

The true measure of the keeping quality of milk is the time which elapses before it actually sours. This is the measure employed by the consumer, but manifestly it cannot be applied in advance at any earlier stage in the commercial life of the milk. A modification of this is possible in that samples of the milk under consideration may be held at high temperatures and the interval before curdling noted. From a comparative study of the effect of a temperature on germ growth, it would then be possible to translate this interval into the time which would elapse before the original milk would sour at the lower temperature at which it would normally be held. This procedure involves some time and technical apparatus which is not often available.

[10] Bacteriological Standards for Milk. U. S. Public Health Reports 29 : 1218-1221. 1914.

[11] Breed, R. S., and Brew, J. D. Counting Bacteria by Means of the Microscope. N. Y. (Geneva) Agr. Exp. Sta. Tech. Bul. 49. 1916.

The commercial milk men have long employed the acid test, as well as their trained sense of taste and smell, in estimating the probable keeping quality of milk as delivered at their plants. By these means they have been able to anticipate somewhat the time at which milk will be no longer acceptable to the whole-milk trade, but it is only as milk approaches this limit that its condition is determinable by these means.

During the past few years there have been suggested a number of technical milk tests more or less closely related to keeping quality, such as the reductase test, the Schardinger reaction, the alcohol test, the catalase test, and the hydrogen ion concentration. In general the availability of these tests seems limited because they are mainly useful only in the later stages of the commercial life of milk.

In view of this unsatisfactory condition of knowledge regarding the measurement and control of the keeping quality of milk, the New York [12] and Illinois [13] Agricultural Experiment Stations have undertaken extended and detailed study of the various factors affecting the entrance and growth of germ life in milk.

COMPLEXITY OF THE PROBLEM

The above outline of the various phases of milk quality brings out the fact that at various times the students of the milk question have been interested first in one, then in another element of milk quality, and that in connection with each such attempt they have succeeded in devising a more or less successful index of quality with regard to the particular point under observation.

This publication is designed to emphasize the fact that the quality of city milk is not a simple matter to be adequately expressed after a consideration of any one factor, but that it is a complex matter which can be expressed only after an adequate consideration and

[12] Harding, H. A., Wilson, J. K., and Smith, G. A. Milking Machines: Effect of Method of Handling on the Germ Content of Milk. N. Y. (Geneva) Agr. Exp. Sta. Bul. 317. 1909.
Harding, H. A., Wilson, J. K., and Smith, G. A. The Modern Milk Pail. N. Y. (Geneva) Agr. Exp. Sta. Bul. 326. 1910.
Harding, H. A., Ruehle, G. L., Wilson, J. K., and Smith, G. A. The Effect of Certain Dairy Operations upon the Germ Content of Milk. N. Y. (Geneva) Agr. Exp. Sta. Bul. 365, pp. 198-233. 1913.
Harding, H. A., and Wilson, J. K. A Study of the Udder Flora of Cows. N. Y. (Geneva) Agr. Exp. Sta. Tech. Bul. 27. 1913.
Ruehle, G. L. A., and Kulp, W. L. Germ Content of Stable Air and Its Effect upon the Germ Content of Milk. N. Y. (Geneva) Agr. Exp. Sta. Bul. 409, pp. 418-471. 1915.

[13] Prucha, M. J., and Weeter, H. M. Germ Content of Milk: I. As Influenced by Factors at the Barn. Ill. Agr. Exp. Sta. Bul. 199. 1917.

evaluation of each of these four essential factors; namely, food value, healthfulness, cleanliness, and keeping quality.

While the percentage of fat in milk is not a perfect measure of the food value, it is an easily determined index of food value. While medical supervision of the health of the cows and the men or proper pasteurization are not absolutely self-sufficient guarantees of the healthfulness of milk, they are the most practicable and easily applied indices of healthfulness. The sediment test, while open to some objections, is a simple and easily applied index of milk cleanliness. The problem of a satisfactory index for keeping quality is not so simply solved. Among the many available tests, that one must be selected which will best suit the purpose in hand.

Much of the confusion in the public mind regarding milk quality has been due to a failure to discriminate properly between germ content and healthfulness, on the one hand, and germ content and cleanliness, on the other.

The introduction of the public to the subject of germ life came thru the attention which was early given to germs as producers of diseases such as tuberculosis [14] and typhoid fever. To the public, bacteria and disease became practically synonymous words. Later the attention of the public was directed to germ life in milk [15] at about the same time that its attention was directed to the possibility of germs of tuberculosis [16] being present in milk. Therefore, it is not at all strange that in public thought germ life and unhealthfulness of milk should have seemed identical.

Early in the present century Metchnikoff [17] and other writers began to lay stress upon the health-giving qualities connected with certain germs in milk, as those of the Bulgaricus group. More recently extensive commercial use has been made, not only of cultured milks of various kinds, but also of vast quantities of buttermilk containing the ordinary sour-milk organisms with or without the addition of cultures of the Bulgaricus forms. There is a continued satisfactory use of these sour-milk drinks which contain many millions or billions of bacteria per cubic centimeter, not only of these special organisms with foreign names, but also of the organisms present in our sour milk of commerce. These experiences are

[14] Koch, R. Die Aetiologie der Tuberkulose. Mitt. aus dem Kaiserl. Gesundheitsamte 2 : 1-88. 1884.

[15] Sedgwick and Bacthelder. A Bacteriological Examination of the Boston Milk Supply. Boston Med. and Surg. Jour. 12 : 25–. 1892.

[16] Russell, H. L. The Infectiousness of Milk from Tuberculous Cows. Wis. Agr. Exp. Sta. Ann. Rpt. 11, pp. 196-200. 1895.

[17] Metchnikoff, E. The Prolongation of Life. 1908.

gradually bringing home to the public an appreciation of the fact that there is very little connection between the amount of germ life in milk and the healthfulness of milk.

The confusion in the public thought between the presence of germ life and cleanliness arises from the fact that it was originally believed that the seeding of milk with bacteria came about primarily as a result of a large quantity of bacteria being carried into the milk upon various forms of foreign matter, such as dirt and dust. Each particle of dust in the barn air was looked upon as an omnibus overloaded with attached germ life.

More recent studies have shown that dust particles, instead of being loaded in the manner described, actually carry living organisms in less than one case out of a hundred.[18] While it is true that a small number of germs are carried into the milk upon dirt, the amount of dirt actually finding its way into the milk is so small in proportion to the mass of the milk that the germ life added in this way is relatively insignificant. The confusion regarding bacteria in milk is being cleared up by studies which show that the real source of contamination of milk is either an unusual population of bacteria in the udder, or far more frequently, the presence of a surprisingly large amount of germ life upon the utensils in which the milk is handled. So persistent is this idea of the constant association of germ life and dirt that the natural inference would be that utensils carrying large numbers of germs were dirty. This inference is not in accord with the carefully observed facts, since germ life is present in vast numbers upon dairy utensils which have been rendered clean in the ordinary sense of the word, but which have not been so handled as to obliterate germ life.

Later studies of germ life in the udder[19] have made it plain that

[18] Compare, for example, the number of dust particles per cubic foot of air as reported on page 61 of Final Report of the Committee on Standard Methods for the Examination of Air (Am. Jour. Pub. Health 7 : 54-72, 1917), where the number of dust particles per cubic foot of the air of New York City streets is given as between 400,000 and 1,000,000, as determined by the filtration method, with the number of bacteria per cubic foot of air as reported by Winslow, C. E. A., and Browne, W. W. (The Microbic Content of Indoor and Outdoor Air. Monthly Weather Review 42 : 452-453, 1914). The average numbers of bacteria which the latter authors report do not exceed 113 per cubic foot for air from the open country, from city streets, from offices, from factories, and from schools.

[19] Ward, A. R. The Invasion of the Udder by Bacteria. N. Y. (Cornell) Agr. Exp. Sta. Bul. 178. 1900.

Harding, H. A., and Wilson, J. K. A Study of the Udder Flora of Cows. N. Y. (Geneva) Agr. Exp. Sta. Tech. Bul. 27. 1913.

Evans, Alice C. The Bacteria of Milk Freshly Drawn from Normal Udders. Jour. Infect. Dis. 18 : 437-476. 1916.

Sherman, J. M. Studies on the Production of Sanitary Milk. Ann. Rpt. Penn. State College for 1914-15.

germ life is constantly present in all samples of normal milk from the time it is secreted by the glands of the udder to the time it is utilized by the consumer.

Too frequently the public thinks of milk merely as a fluid containing butter fat, while it should of course recognize the fact that milk also normally contains about 5 per ct. of milk sugar, as well as varying amounts of nitrogenous substances which become most prominent in such things as cottage cheese. Until a few years ago, few people appreciated that in the process of milk secretion, worn-out gland cells and blood corpuscles are thrown off into the milk and form a part of normal milk, since they are uniformly and regularly present in considerable numbers in all milks.[20] The recentness of our appreciation of the normal presence of these cells in milk is shown by the fact that up to a few years ago in certain cities there existed regulations forbidding the presence of what are now known to be fairly normal quantities of these cells in milk.

While the public is generally aware of the fact that milk always contains considerable quantities of germ life, it has probably not yet come to appreciate the fact that germs in milk are just as constant, and therefore just as normally a part of milk, as are milk sugar, fat globules, and body cells. The consumer has little interest in the germ content of milk except for a limited number of disease-producing forms against which he has a right to insist upon adequate protection, and except in so far as the germ life produces objectionable changes such as souring or bad flavors in the milk itself.

COMPOSITE EXPRESSIONS OF QUALITY

As has already been stated, the students of milk have recognized more or less distinctly the various elements of milk quality. However, the public mind insists upon a simple, direct statement of quality regardless of the complex relationship involved. It insists that a milk must be *good*, *medium*, or *bad*. Various plans have been devised for meeting this demand and furnishing a composite expression for milk quality.

CERTIFIED MILK

Certified, as applied to milk, signifies that it has the food value of normal 4-per-ct. milk, the healthfulness resulting from a careful medical supervision of all animals and men connected with the pro-

[20] Breed, R. S. Cells in Milk Derived from the Udder. N. Y. (Geneva) Agr. Exp. Sta. Bul. 380. 1914.

duction and handling of the milk, the cleanliness following careful attention to the cleanliness of the animals and the utensils, and the keeping quality to be expected of fresh milk with a low germ content, kept at a very low temperature.

SCORE CARD

As a measure of the desirability of the ordinary milk supply, various dairy score cards have been suggested. These score cards are an attempt to express on a percentage basis the protection given milk on the farm from the danger of contamination with disease-producing germs both from animals and from men (healthfulness); the protection given milk from dirt (cleanliness); and the protection given milk by care of utensils, by cooling, and by prompt delivery (keeping quality). These score cards have uniformly failed to take account of the food value of the milk. Since these score cards are arranged on the basis of the agricultural methods and equipment rather than on the basis of the milk, it is but natural that in the cards themselves there should be much confusion regarding the items which apply respectively to healthfulness, cleanliness, and keeping quality. Some have expected to find correlation between germ content and the dairy score; others feel that there should be a correlation between cleanliness of the milk from dairies and the dairy score; while others expect a correlation between the score of the dairy and the presence or absence of disease germs. Such comparisons on the basis of a single element of equality are necessarily unfair to the score card unless it is recognized that the dairy score combines factors connected with all three elements of quality.

The essential difficulties of present score cards arise from the fact that they are an attempt to evaluate the influence of dairy environment and processes upon the milk, when the relative importance of such factors has not yet been sufficiently determined.

Grade.— This presentation would be very incomplete if it did not include a suggestion as to the manner in which the four elements of milk quality herein discussed might be combined so as to form a basis for defining grades of milk. The following is offered as a suggestive outline rather than as a finished plan for milk grading:

GRADE	ELEMENT OF QUALITY	DEGREE OF EXCELLENCE
Special milk	Food value	Fat content as stated on package
	Healthfulness	Medical supervision of health of men and animals, or proper pasteurization
	Cleanliness	Sediment, not more than a trace
	Keeping quality	Excellent

Grade	Element of Quality	Degree of Excellence
Table milk	Food value	Fat content as stated on package
	Healthfulness	Properly pasteurized
	Cleanliness	Sediment, not more than a small amount
	Keeping quality	Good
Cooking milk	Food value	Fat content as stated on package
	Healthfulness	Boiled
	Cleanliness	May not be sufficient for table grade
	Keeping quality	May not be sufficient for table grade

Under the grade of *special milk*, the plan provides for milk of any desired composition to meet any special need, such as baby feeding. The grade of *table milk* will normally include the ordinary city supply. The grade of *cooking milk* is designed for milk not sufficiently fresh or not carefully enough handled to be suitable for the table grade. In order to assist in protecting the consumer from unwittingly purchasing cooking milk instead of table milk, it is suggested that cooking milk be boiled. Such treatment will adequately protect healthfulness, and while making this grade of milk readily recognizable, will not injure it for the use for which it is designed.

RESPONSIBILITY OF THE PRODUCER FOR MILK QUALITY

If the foregoing analysis of milk quality is correct, the producer sustains relations to each of the elements of milk quality somewhat different from what has been ordinarily supposed. Contrary to current belief, he is unable to control food value to any appreciable extent by his method of feeding the cow. The forces of heredity have determined what shall be the composition of the milk of a given animal, and except for slight seasonal variations or local disturbances a cow persists in giving milk of essentially a fixed composition. On the other hand, by selecting his animals he is able to produce milk of widely different food value, but at a correspondingly different cost of production. Manifestly, it must be expected that he will produce a milk having a food value which will give him the widest margin of profit.

In the matter of healthfulness, the producer has the responsibility of protecting, in so far as he is able, the milk supply from contamination by disease-producing organisms derived from either cows or people. His recognized inability satisfactorily to protect milk in this way calls for the added protection of medical supervision of the health of the cows and men, or of pasteurization; but medical inspection and pasteurization are, manifestly, not the producer's problem.

The element of cleanliness is largely in the control of the producer. Under present economic conditions, he is producing a milk with a very high degree of cleanliness, and if any additional stress is laid upon this point he will undoubtedly produce milk which is uniformly very clean.

The element of keeping quality is the one which presents the greatest practical difficulty, because here the responsibility is much divided. Definite information regarding many details is still lacking, but the present stage of knowledge suggests that the most common factor contributing to poor keeping quality is the condition of the milk cans which are supposed to be properly treated at the milk plants. Where milking machines are used, they are very frequently a large contributing factor to the short keeping quality of the milk.

The adoption by the producer of the uniform practice of rinsing his milk utensils with scalding hot water shortly before they are used, would contribute very much to the keeping quality of the milk. In practice each utensil coming into contact with the milk adds to its germ content and decreases its keeping quality. A reduction of the number of such utensils to the minimum is very desirable.

Under ordinary conditions the udder of the cow contributes but a small number of germs and these have little effect upon the milk. Occasionally, however, cows or even herds are found where the udder content is high and the effect upon the keeping quality of the milk pronounced. Further information is necessary before the true significance of this factor can be accurately estimated.

RESPONSIBILITY OF THE DISTRIBUTOR

The responsibility of the distributor in the matter of food value concerns itself essentially with conserving the food value of the milk as furnished him by the producer. Where economic conditions permit, he is able to stimulate the production of milk with a higher food value by paying a differential price.

For the healthfulness of milk a heavy responsibility lies upon the distributor, particularly when he is charged with its pasteurization as a final safeguard to the consumer. As a possible source of disease-producing germs, human beings are more dangerous than cows, and a medical supervision of the employees of the milk plant is desirable. This is particularly important in the case of milk pasteurized in bulk, since this process gives no protection from the later contamination, which is a more or less remote possibility during the cooling and bottling processes.

The milk as it comes from the producer usually is and always should be clean. The problem of the distributor is to preserve this cleanliness.

The keeping quality of milk is more largely within the control of the distributor than is usually supposed. He is frequently responsible for the washing and steaming of the milk cans. Where this steaming is done in a perfunctory manner, particularly where tight-fitting covers are applied to wet cans in warm weather, these cans become one of the most important factors in reducing the keeping quality of the milk. Where a proper washing of the cans is followed by a thoro steaming and the cans are carefully dried before being covered, they will have little objectionable effect upon the milk. The large germ content added to milk by utensils within the distributor's plant is frequently an important factor in impairing its keeping quality. The milk coolers and the bottling machines require special watching in this connection, not only because they frequently add large numbers of germs, but especially because they add them *after the milk has been pasteurized.*

The intelligent application of steam to all of the utensils should be a routine procedure, and the flushing out of all utensils with scalding water shortly before using them is a valuable additional precaution.

RESPONSIBILITY OF THE CONSUMER

The food value of the milk furnished the consumer will depend primarily upon what the consumer desires and is willing to pay for. A considerable proportion of the consumers are desirous of obtaining a milk carrying 4 per ct. of fat or more, and where the milk has been sold regardless of food value they have striven to find the richest milk available at a given price. If each bottle of milk carried a statement of its fat content, the responsibility would then be upon the consumer to recognize and pay for increased food value.

The consumer thru his agents, the health officials, must determine how the healthfulness of the food supply shall be safeguarded. The dangers which naturally surround milk production and handling are such that if the milk supply is to be safe it must be protected either by a medical supervision of the health of the cows and the men or by proper pasteurization, or better, by a combination of both means of protection.

The cleanliness of milk, as it is now delivered to the consumer is in general very satisfactory, but continued emphasis is needed to insure that it shall be constantly maintained at a high level.

The keeping quality of milk is constantly receiving the attention of the consumer, since there is no other shortcoming of milk which is more quickly impressed upon him. The delivery to the consumer of old, stale milk, on the verge of souring, is quite as much a fraud as the delivery of milk deficient in food value, healthfulness, or cleanliness. The consumer is constantly insisting on improvement in keeping quality, and his desires will be met as rapidly as the producer and the distributor find economical means of insuring this improvement.

Since the keeping quality of milk after delivery is dependent primarily upon the temperature at which the milk is held, the responsibility rests upon the consumer to hold the milk at a reasonably low temperature after it is delivered to him. Too frequently little regard is given to this matter by the consumer, and much of the criticism directed against the keeping quality of milk is accordingly unjust.

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SEED TESTING

E. G. Montgomery

Every year a considerable acreage of land is planted with seeds so poor in germinating quality that partial or complete failure of the crop is the result. Seed testing however is very simple, and a number of practical homemade germinators are here described.

Fig. 60. TESTING SEED CORN
The one hundred ears of corn in the rack may be tested at one time in this sawdust box germinator. The squares in the germinator correspond in number and position to the compartments in the rack

PLATE GERMINATOR

The plate germinator is made from two pie tins or dinner plates and some absorbent material, such as blotting paper, coarse wrapping paper,

or cloth. In the bottom of the tins or plates place several layers of the absorbent material, wet it thoroly, and scatter on it the seeds to be germi-

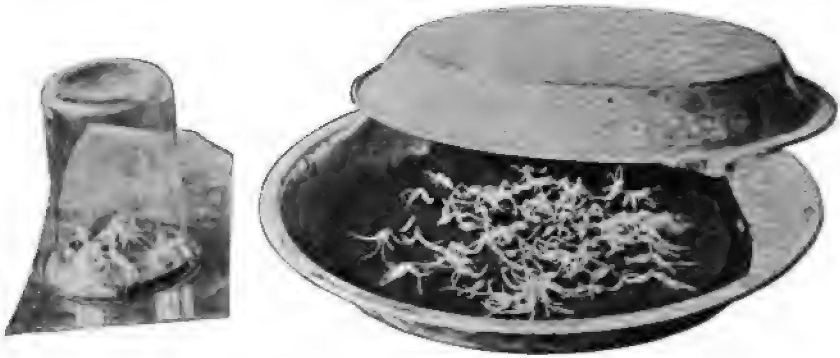

FIG. 61. TWO TYPES OF HOMEMADE SEED GERMINATORS
On the left, a germinator made by inverting a glass tumbler over two or three layers of wet blotting paper placed on a piece of glass. On the right, a plate germinator with blotting paper in the bottom as an absorbent

nated. If plenty of absorbent has been used, it will not be necessary to place a paper or a cloth over the seeds. Invert the second plate over the first as a cover, and see that the edges fit closely in order to make a moist chamber. This is a good germinator for oats, wheat, barley, grass and clover seeds, or corn.

FIG. 62. A SAWDUST GERMINATOR
A tin box with sawdust in the bottom and a sawdust pad in the top. This is a very convenient germinator for schools as it can be carried about

GLASS TUMBLER GERMINATOR

For small seeds, such as grass or clover, an ideal germinator can be made with a piece of glass, a glass tumbler, and some blotting paper. Cut two pieces of blotting paper so that they will just fit inside the tumbler. Lay these on top of each other on the piece of glass, wet them thoroly, and scatter on the top the seeds to be germinated. Invert the tumbler over the blotting paper, and set the germinator in a warm place. As a rule no more water is needed, but if the blotting paper becomes dry a little can be added. This type of germinator interests children because they can watch the germination as it progresses from day to day.

SAWDUST BOX GERMINATOR

A shallow box three inches to four inches deep and as nearly water-tight as possible is needed for the sawdust box germinator. Place in it two to three inches of sawdust, tamp it down, thoroly moisten it, and cover it with a cloth. Place the seeds to be germinated on the cloth, cover them with another cloth, and spread about one inch of damp sawdust over the top. The covering is easier to handle if made into a sawdust pad about one inch thick (fig. 62).

This germinator is particularly good for testing corn. It may be made two or three feet square and used for testing individual ears as follows. Mark the cloth into three-inch squares in checkerboard fashion, and place about six grains from each ear in each square. Give the squares and the ears corresponding numbers, or pile the ears or place them in a rack in positions that correspond with the squares in the germinator (fig. 60). By this method it will be possible to locate the poor ears and discard them. In a box thirty inches square one hundred ears can be tested at a time.

RAG-DOLL GERMINATOR

The rag-doll germinator is made as follows from a double strip of cotton flannel about six inches wide and thirty inches long. Lay it on a table, spread the seeds on it, roll it up loosely, and tie it. Place this roll in a bucket of lukewarm water for twelve hours, pour off the water, and cover

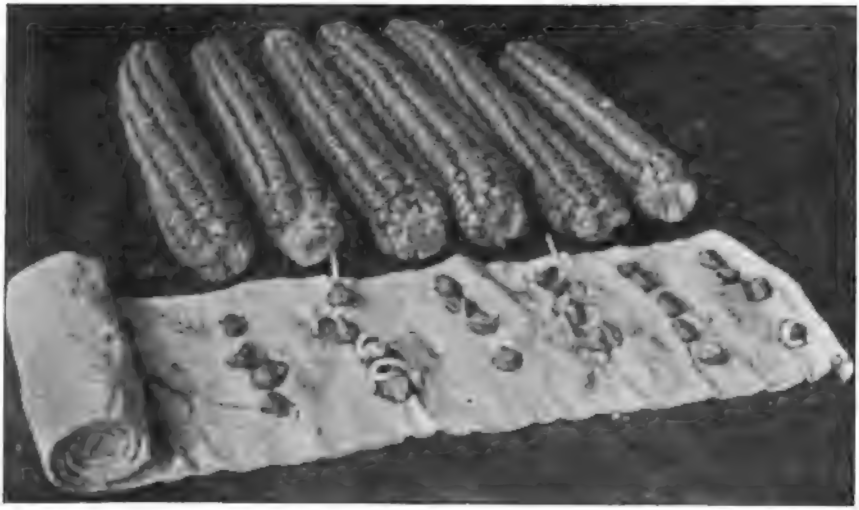

FIG. 63. THE RAG-DOLL GERMINATOR
This shows a method of germinating grain from individual ears

the bucket in order to keep the "rag-doll" moist. The rag-doll germinator also is used in testing individual ears of corn. Lay the ears side by side on a table, and lay the strip of cloth along the butt ends of the ears. Take five or six grains from each ear, and place them on the cloth

opposite that ear. Leave the ears in place until germination is complete, then unroll the " rag-doll " so that the germinated seeds will be opposite the ears from which they were taken. The ears that have germinated well can be seen at once and the others discarded.

TEMPERATURE FOR GERMINATION

Seeds of clover and most grasses germinate at lower temperatures than cereals. A thermometer should be hung near the germinator to record ranges in temperature. Clover and grass seeds germinate well at a temperature ranging from 50° to 80° F., and cereals at temperatures from 65° to 85° F. A temperature that is cool for eighteen hours and warm for six hours, imitating the daily fluctuating air temperature, usually gives better results than a constant temperature.

An egg incubator or an oats germinator is an excellent apparatus for germinating seeds, as the temperature is easily regulated.

LIFE OF SEEDS

Good sound seed of grass, clover, or grain will keep at least three years under good storage conditions. Seed generally contains an excess of moisture when first harvested, and it must be thoroly air-dried without either heating or freezing. After that, it is only necessary to keep seeds dry, a rather difficult matter in humid climates. The best place in which to store seed on the farm is usually the house garret or the second floor of a barn in which no stock is kept or which is at least not directly over stock. Dry seed is not injured by freezing, but seed only slightly damp is very quickly killed by a hard freeze.

FIG. 64. GERMINATION OF CORN

A, a grain before germination; B, a grain from which the surface has been shaved in order to show the young germ; C, first stage of germination

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Apple and Thorn Skeletonizer

E. P. Felt

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APPLE AND THORN SKELETONIZER

Hemerophila pariana Clerck

E. P. FELT[1]

Another introduced apple insect has become well established in Westchester and Rockland Counties, New York, the center of the infestation being near Irvington and Nyack, respectively. It is a small European moth, which has been termed the apple and thorn skeletonizer. It is classed as one of the apple insects of minor importance in Europe tho this may not necessarily prove to be the case in America, since some of the most destructive introduced species here are of relatively slight importance in their native countries. The caterpillars feed on the upper surface of the leaves almost entirely, and it is therefore relatively easy to apply poison where it will do the most good. This considerably simplifies the problem of control and renders it fairly easy to keep this pest within bounds until its status can be determined or natural enemies have an opportunity to assert themselves and prevent widespread and material damage. The insects are already sufficiently numerous near the center of the infested area to defoliate entire orchards, and conditions favor a continuation of the spread with accompanying serious injury unless there is early, thoro, and general spraying in the infested area next summer.

FIG. 65. THE WORK OF THE APPLE AND THORN SKELETONIZER

Apple leaf almost entirely skeletonized and showing the somewhat characteristic folding over or curling of the edges

RECOGNITION CHARACTERS

This pest skeletonizes apple leaves in much the same way as the well-known cankerworms, except that the latter more usually devour all the vital tissues of nearly every leaf; whereas this newly introduced caterpillar generally confines its attack to portions of many

[1] State Entomologist of New York. This bulletin is published by courtesy of the Director of the New York State Museum.

leaves (frequently practically all the leaves on a tree may be eaten in this manner), feeding near the center under a slight web and extending upward and outward to include most of the tip of the leaf as illustrated in the figure on the cover of this bulletin. Areas on each side of the basal part of the leaf are often untouched. Frequently the margins to the width of half an inch or so are turned over, and a badly eaten leaf may present the appearance illustrated in figure 65. There is no webbing together and inclosing leaves in masses, as is so characteristic of the work of the native fall webworm and also seen to a less extent in the nests of the brown-tailed moth caterpillar. Both of these last-named species produce moderately firm to thick webs which inclose the leaves, something never done by this newly introduced insect. Moreover the caterpillar of the apple and thorn skeletonizer is active, yellowish, black spotted, practically naked, and about half an inch long; whereas both of the above-mentioned tent-making caterpillars are distinctly hairy, slower in movement, and, when full grown, an inch or more in length.

FIG. 66. MOTH OF THE APPLE AND THORN SKELETONIZER

This specimen is unusually well marked. The coloration of the moths varies greatly. The moth as shown here is four times natural size

FIG. 67. SIDE VIEW OF PUPA

Six times natural size

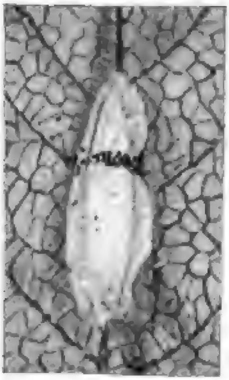

FIG. 68. COCOON ON LEAF

The oval true cocoon is partially revealed thru its covering of webbed silk. Two times natural size

DESCRIPTION

The moth (fig. 66) is a dull grayish brown or dark brown somewhat purplish insect having a wing spread of a little less than half an inch. The conspicuous feelers, or antennæ, are long, slender, dark brown, with numerous fine white rings. The smaller feelers, or palpi, are moderately prominent and are mottled with yellowish and dark brown scales. A closer examination shows that the head is mostly purplish brown with a yellowish cast above the mouth. The body is thickly covered with dark brown scales variably mottled with yellowish brown, the hind portion, or abdomen, being a little darker. Well-marked specimens have near the base of the fore wing a rather broad, broken, angular dark band at what is known as the basal third, and a less distinct and more regular tho somewhat broken dark band near the outer fifth. An area between

this and the basal third is variable grayish with one or more dark spots on the front margin. The hind wings are darker gray, and both pairs of wings have the outer and hind edges bordered with rich purplish brown scales.

FIG. 69. DORSAL, OR TOP, VIEW OF A TYPICAL PALE GREENISH CATERPILLAR

The spots in this specimen are average size. The caterpillar is six times natural size

The pupa (fig. 67) is only about one-fourth of an inch long, moderately stout, and mostly dark bronzy yellow variably marked with darker areas, especially on the last segment of the abdomen.

The cocoon (fig. 68) is spun on the upper surface of the leaf and consists of a narrowly oval mass of thick white webbing about five-eighths inch long and one-fourth inch wide. This webbing is frequently near the midrib and covers the true cocoon, which is faintly seen beneath. The pupa wriggles out partly from under the webbing before the moth escapes, and the empty pupal shell is left projecting from the cocoon.

The caterpillars (figs. 69 and 70) are somewhat variable in appearance. The smallest are about one-eighth of an inch long and mostly pale greenish yellow. The head is amber colored with somewhat conspicuous dark brown closely placed single eyes, or ocelli, on the sides. The body segments are mostly a uniform yellowish; the true legs are pale yellowish with the second segment blackish. The false, or prolegs, of the abdominal segments are well developed. Older caterpillars, about three-sixteenths inch long, are decidedly darker tho the general coloration is nearly the same. The warts, or tubercles, on the body are much larger and in some specimens almost touch each other and give the appearance of broken black lines, tho in reality they are simply series of closely set tubercles. The true legs have the first two segments more or less blackish and quite different from the younger stages. The full-grown caterpillars are nearly half an inch long and are practically the same as the older caterpillars just described.

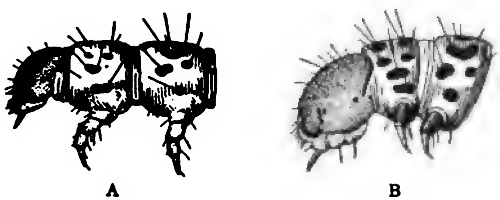

FIG. 70. HEAD AND FIRST TWO BODY SEGMENTS OF CATERPILLAR

A. Side view showing the arrangement of the warts, or tubercles, and the structure of the legs. Ten times natural size

B. Side view of a smaller, darker caterpillar. Note the relative size of the black warts, or tubercles. Twelve times natural size

DISTRIBUTION

The apple and thorn skeletonizer is probably widely distributed, since it has been recorded from England, France, Germany, the Balkan Peninsula, Bithynia, and west in

Asia to Turkistan. The range suggests that the insect can maintain itself over most of the United States and southern Canada.

This apple pest has become established in New York State in an area, determined in cooperation with Dr. G. G. Atwood of the State Department of Farms and Markets, centering approximately around Ardsley and Irvington and extending east to White Plains and possibly Mt. Kisco, south to Harrison, and north to Croton. It also occurs on the west bank of the Hudson River, ranging for a mile or two north and south of Nyack and west to West Nyack. Apparently there is less injury on the west bank of the Hudson, suggesting that the insect obtained its foothold on the east bank and from there has been gradually spreading. The probabilities are against the rapid dissemination of this insect tho there is no definite information as to just how long it has been established in this country.

LIFE HISTORY

It has not been possible to work out the complete life history of this insect under American conditions tho there is no reason for thinking that the moth has departed materially from its habits as recorded in Europe. J. W. Tutt states that adults occur in September and October on flowers of Compositæ, while William West records capturing specimens among goldenrod.

The moths and probably the pupæ hibernate, the former in any shelter such as thatch and the latter in cocoons attached to leaves. The overwintered moths or those issuing from pupæ deposit eggs probably when the leaves are partly developed, since Meyrick records larvæ in England during May, June, and August. Gelin and Lucas report them in France in April and September, and Rouast in August and September, while Grund records them in Bohemia during June and July and Dr. Reh in Germany during spring and late summer. These data indicate at least two and probably three generations annually. There is considerable variation in development toward the end of the season, at least under American conditions. Full-grown and very small larvæ were found simultaneously at Irvington in September and even in early October, a few larvæ feeding to the latter part of the month. Larval growth is probably completed within four to six weeks. The type of injury suggests that the moths deposit a few eggs near the base of each leaf and when numerous may oviposit on almost every leaf.

INJURY

One of the striking features of an infestation is the general distribution of partly injured leaves thruout the tree or even the entire orchard. The feeding on each leaf is, practically speaking, independent of that upon

other leaves. There is no inclosing and webbing them together as with the fall webworm. The small caterpillars feed almost entirely upon the upper surface, skeletonizing the leaves more or less completely and working from the lower part of the midrib upward and outward so that, unless the infestation is unusually severe, areas on each side of the basal parts of the leaf frequently remain untouched, as illustrated in the figure on the cover. This type of injury is characteristic of moderately infested orchards; those badly infested may have practically every leaf on all the trees completely skeletonized, as shown in figure 65.

This insect shows a marked preference for apple tho it has also been recorded by European writers as feeding on pear, hawthorn, mountain ash, birch, and possibly willow.

NATURAL ENEMIES

Meyrick's statement to the effect that this skeletonizer is local in England indicates moderately efficient natural enemies, and this is borne out by its classification as a pest of minor importance by continental writers. Dr. Reh gives the following list of parasites: *Angitia glabricula* Holmgr., *Mesochorus pectoralis* Rag., *Microgaster* sp., *Phygadeuon* and *Thryptocera crassicornis* Meign. It is possible and certainly to be hoped that some of its native enemies have become established with this skeletonizer, and if this is not the case the chances are that certain parasites native to this country will become accustomed to this new food supply and assist materially in reducing its abundance. One parasite, *Dioctes obliteratus* Cresson, kindly determined by Mr. Gahan thru the courtesy of Dr. L. O. Howard, has already been reared from material received from Westchester County.

CONTROL MEASURES

There is no question but what thoro and timely spraying with a poison, such as arsenate of lead, will destroy the caterpillars, and, owing to their feeding almost entirely on the upper surface of the leaves, a general application in infested areas to all trees on which the pest can subsist would mean its early control and practical elimination so far as material damage is concerned. Furthermore, the adoption of such measures would be a most effective check on a rapid spread and consequent extensive injury. Residents of the infested section are most strongly advised to watch for the development of the insect next season and to spray with an arsenical poison all trees showing signs of its work. It is very important to control it so far as possible, because experience has demonstrated that it is easier to handle an outbreak in its incipiency than to begin after serious losses have occurred.

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WHOLESALE PRICES AND RECEIPTS OF APPLES IN BOSTON FOR THIRTY-SIX YEARS

F. E. Rogers[1]

The results of a study of the wholesale prices and receipts of apples in New York City for twenty years are given in Circular 22 of the Cornell University Agricultural Experiment Station. A similar investigation of the receipts and prices on the Boston market is here given.

The data were obtained from the *Weekly Review* of the *Boston Produce Market Report*, and refer only to the Boston market. The *Boston Produce Market Report* is published daily, and the daily reports are averaged for the *Weekly Review*. The quotations given represent prices obtained by receivers for wholesale lots, and are intended to represent actual sales. The monthly prices are determined by averaging the weekly prices. The receipts per week were also taken from the *Weekly Review*. In all computations three boxes are figured as one barrel.

RECEIPTS OF APPLES IN BOSTON

The monthly and yearly receipts of apples in Boston for the thirty-six-years period, 1879–80 to 1914–15, are given in table 1. The last ten-years period shows a slight decrease in receipts over the previous period. It is interesting to note at this point that the population of the city of Boston increased 23.6 per cent from 1880 to 1890; 25.1 per cent from 1890 to 1900; and 19.6 per cent from 1900 to 1910. The receipts of apples are heaviest in November and lightest in June. Over half of the apples are received during October and November.

AVERAGE PRICES OF ALL VARIETIES

The average price of all varieties for all months and all years, summarized for each period, is given in table 3. The receipts and prices are shown in figure 71.

[1] The author wishes to make acknowledgment to Dr. G. F. Warren for suggestions and assistance in the preparation of this bulletin.

All varieties that were quoted consistently were considered in table 5. Each variety has equal weight for the months for which it is quoted. Of course, this allows for some error since some varieties are received in larger quantities than others, and should therefore receive greater weight in the make-up of a table of this kind. However, no figures could be obtained that gave the receipts separately for the different varieties. The varieties considered in this table are Ben Davis, Northern Spy, Baldwin, Russett, Tolman, Tompkins King, Astrachan, Sweet Bough, Norfolk, Hubbardston, Pound Sweet, Williams, Fameuse, Rhode Island, Wealthy, McIntosh, Wolf River, Alexander, Harvey (Maine), Twenty Ounce, Gravenstein, and Oldenburg.

PRICES OF VARIETIES

The prices of different varieties by years are given in table 5. Most varieties show a decrease in price for the first three periods with a marked rise during the last ten years. Ben Davis and Nova Scotia Gravenstein, however, show a decrease in price during the last ten-years period over the previous ten years. The average prices of varieties by months during the different periods are given in table 6.

TABLE 1. MONTHLY AND YEARLY RECEIPTS OF APPLES IN BOSTON FOR 1879–80 TO 1914–15

Season	July	August	September	October	November	December	January	February	March	April	May	June	Total
1879–80	5,565	17,047	20,684	60,494	168,430	38,492	23,609	23,342	23,668	7,930	5,986	2,066	397,313
1880–81	10,292	10,113	51,997	188,526	206,568	79,593	56,107	51,752	43,736	22,403	11,243	2,921	735,251
1881–82	7,657	26,935	26,263	84,428	171,966	19,483	20,261	36,687	29,988	19,138	5,739	1,428	449,973
1882–83	6,726	14,324	25,339	102,067	119,427	35,246	19,140	10,809	9,230	6,345	4,029	494	353,176
1883–84	5,056	13,978	24,716	43,144	113,362	18,607	7,458	11,443	10,536	7,183	3,535	1,427	260,445
1884–85	15,871	17,675	38,533	134,486	200,338	69,639	42,217	36,451	39,819	17,649	6,068	2,297	621,043
Yearly average for 6 years	8,528	16,679	31,255	102,191	163,348	43,510	28,132	28,414	26,163	13,441	6,100	1,772	469,534
1885–86	10,280	12,180	20,495	100,934	160,724	59,893	48,114	24,595	25,015	19,760	9,528	4,646	496,164
1886–87	12,832	14,712	23,447	185,406	216,527	75,643	37,638	23,300	12,303	12,148	3,528	1,512	618,996
1887–88	8,125	13,832	19,453	85,495	110,026	57,051	32,617	31,436	22,564	15,684	4,694	1,087	402,064
1888–89	6,767	10,187	30,506	138,495	214,771	59,211	18,327	15,857	24,957	16,971	7,705	1,639	545,393
1889–90	7,442	15,319	31,117	105,493	138,726	34,208	16,466	15,259	9,791	6,650	2,922	1,130	384,523
1890–91	7,538	9,060	21,855	46,725	52,099	13,818	11,657	11,250	7,229	5,929	1,675	2,099	190,934
1891–92	12,616	19,770	18,179	65,523	205,433	65,363	48,139	60,973	39,860	21,218	9,608	1,423	568,105
1892–93	2,968	11,367	33,179	134,777	144,954	86,583	29,166	36,090	43,547	33,670	14,602	4,211	575,114
1893–94	11,515	10,344	8,483	46,153	47,255	24,477	10,535	4,951	7,801	2,796	552	127	174,989
1894–95	5,009	18,650	44,915	215,507	225,990	57,788	63,900	21,545	16,038	10,178	4,129	1,205	684,854
10-years average	8,509	13,542	25,163	112,451	151,650	53,404	31,656	24,526	20,910	14,500	5,894	1,908	464,114
1895–96	12,646	13,406	31,198	85,198	124,808	31,018	24,992	24,337	17,587	9,267	4,129	197	378,783
1896–97	7,594	26,382	100,606	266,620	264,558	122,160	73,663	139,425	80,795	36,289	10,941	2,114	1,131,147
1897–98	6,753	13,917	27,086	158,767	121,876	42,517	25,036	26,303	19,556	19,847	3,825	68	465,551
1898–99	5,358	12,843	35,389	127,586	121,778	47,444	15,682	16,770	21,609	10,907	2,579	76	418,021
1899–1900	9,039	21,413	26,795	155,290	174,990	61,787	20,766	9,769	9,616	7,509	435	126	497,535
1900–01	11,936	14,241	19,943	183,906	223,969	118,454	50,329	21,615	27,101	10,604	3,532	810	686,440
1901–02	5,418	9,787	26,140	83,872	120,375	62,419	41,824	18,756	15,181	10,601	2,039	821	397,233
1902–03	15,383	18,707	77,933	282,242	323,871	202,541	94,707	85,058	88,203	39,137	18,642	12,861	1,259,285
1903–04	10,370	22,774	72,939	217,544	371,599	151,612	119,314	91,844	71,547	38,465	16,463	5,267	1,189,738
1904–05	6,744	18,174	49,016	223,506	300,081	136,742	136,948	70,908	77,876	54,266	24,638	6,628	1,105,527
10-years average	9,124	17,164	46,704	178,453	214,790	97,669	60,326	50,478	42,907	23,689	8,722	2,897	752,926
1905–06	8,350	14,370	33,980	166,249	208,892	121,980	66,850	47,493	23,645	12,411	3,665	661	708,546
1906–07	13,229	17,271	48,647	266,394	305,698	103,332	43,952	41,892	40,521	22,850	4,942	775	909,503
1907–08	838	6,877	24,708	113,764	269,559	82,971	44,450	51,593	84,169	43,148	23,782	4,562	750,421
1908–09	6,872	13,266	31,981	132,378	118,232	52,922	23,538	23,393	8,700	9,224	2,430	321	423,257
1909–10	656	4,341	15,892	90,540	134,079	78,099	30,840	31,963	47,592	25,361	4,218	1,306	464,887
1910–11	6,253	15,063	37,223	232,361	293,959	75,583	35,523	26,015	18,871	13,672	4,174	1,656	760,353
1911–12	3,063	15,466	31,867	200,268	274,249	127,090	31,910	32,293	26,522	17,033	6,886	1,067	767,714
1912–13	8,864	12,715	39,972	268,332	354,309	100,597	63,547	56,103	43,432	45,559	14,861	2,344	1,010,635
1913–14	2,408	4,030	14,594	149,648	193,205	74,536	37,105	19,074	19,568	9,623	5,277	2,293	531,361
1914–15	10,287	9,772	22,227	177,863	164,011	106,066	64,246	63,194	80,710	74,687	10,749	3,866	787,678
10-years average	6,082	11,317	30,109	179,780	231,619	92,318	44,196	39,301	39,373	27,357	8,098	1,885	711,436

TABLE 2. AVERAGE MONTHLY RECEIPTS OF APPLES IN BOSTON

	1879–80 to 1884–85		1885–86 to 1894–95		1895–96 to 1904–05		1905–06 to 1914–15	
	Average receipts	Percentage of total	Average receipts	Percentage of total	Average receipts	Percentage of total	Average receipts	Percentage of total
July	8,528	1.8	8,509	1.9	9,124	1.2	6,082	0.9
August	16,679	3.6	13,542	2.9	17,164	2.3	11,317	1.6
September	31,255	6.6	25,163	5.4	46,704	6.2	30,109	4.2
October	102,191	21.8	112,451	24.2	178,453	23.7	179,780	25.3
November	163,348	34.8	151,650	32.7	214,790	28.5	231,619	32.6
December	43,510	9.3	53,404	11.5	97,669	13.0	92,318	13.0
January	28,132	6.0	31,656	6.8	60,326	8.0	44,196	6.2
February	28,414	6.0	24,526	5.3	50,478	6.7	39,301	5.5
March	26,163	5.6	20,910	4.5	42,907	5.7	39,373	5.5
April	13,441	2.8	14,500	3.1	23,689	3.1	27,357	3.8
May	6,100	1.3	5,894	1.3	8,722	1.2	8,098	1.1
June	1,772	0.4	1,908	0.4	2,897	0.4	1,885	0.3

TABLE 3. AVERAGE PRICE OF ALL VARIETIES BY MONTHS FOR ALL YEARS

Season	July	August	September	October	November	December	January	February	March	April	May	June
1879–80	$3.12	$2.28	$2.07	$2.19	$2.62	$2.54	$2.54	$2.83	$3.00	$3.34	$3.93	$2.85
1880–81	2.00	1.30	1.26	1.19	1.42	1.47	1.49	1.76	1.53	2.03	2.41	3.63
1881–82	4.00	2.92	3.11	2.74	3.22	3.05	3.02	3.13	3.00	3.48	4.88	....
1882–83	3.69	3.52	3.09	2.92	2.94	3.44	3.62	3.43	3.69	3.75	4.69	5.43
1883–84	3.00	4.08	4.19	3.38	3.54	3.62	3.61	3.75	4.03	4.49	5.10	4.88
1884–85	2.38	1.94	1.66	2.03	2.04	2.10	1.91	1.94	2.13	2.18	2.57	3.13
1885–86	$2.38	$2.15	$2.56	$2.01	$1.69	$1.72	$1.65	$1.60	$1.54	$1.49	$2.08	$2.16
1886–87	2.67	1.98	1.67	1.75	1.84	2.12	2.50	2.51	2.54	3.84	4.37	3.75
1887–88	2.66	2.06	2.00	1.87	2.36	2.37	2.48	2.76	2.71	3.06	3.40	4.13
1888–89	2.53	2.32	2.41	1.96	1.82	1.69	1.49	1.27	1.20	1.33	2.48	2.42
1889–90	3.70	3.26	2.42	2.68	2.74	2.83	2.91	3.31	3.62	3.82	4.25	4.02
1890–91	2.00	4.04	3.92	3.58	4.04	4.05	4.26	4.33	4.53	4.29	4.50	3.25
1891–92	3.67	1.64	2.16	2.03	1.79	1.64	1.73	1.79	1.86	2.16	3.04	3.84
1892–93	2.23	2.41	2.66	2.28	2.45	2.30	2.41	2.54	2.68	2.39	2.83	2.75
1893–94	2.88	2.28	3.16	2.79	3.02	3.52	4.03	4.32	4.77	4.65	5.13	....
1894–95	1.56	1.73	1.82	1.86	1.80	2.02	2.82	3.14	3.10	3.23	2.81	3.06
1895–96	$1.99	$2.10	$2.01	$1.96	$2.45	$2.58	$2.67	$2.77	$3.10	$3.31	$3.30	$4.33
1896–97	2.37	1.24	1.24	1.37	1.13	1.26	1.15	1.29	1.27	1.45	1.83	2.88
1897–98	2.60	2.34	2.82	2.65	2.87	3.19	3.71	3.67	3.55	3.51	3.59	3.58
1898–99	2.00	2.08	2.05	2.40	2.60	2.86	3.05	3.17	3.45	3.88	4.50	4.00
1899–1900	2.03	2.27	2.30	2.28	2.23	2.37	2.63	2.71	3.32	3.54	4.14	....
1900–01	....	1.53	1.73	1.89	1.84	2.15	2.25	2.43	2.58	3.01	3.36	....
1901–02	2.51	2.67	3.28	3.25	3.34	3.50	3.71	4.13	3.96	3.85	4.40	4.50
1902–03	2.55	1.98	1.51	2.01	1.94	1.91	2.00	1.88	1.91	1.91	2.03	2.26
1903–04	2.38	2.61	2.38	2.62	2.46	2.26	2.34	2.46	2.56	2.34	2.58	2.63
1904–05	2.73	1.96	1.81	1.78	1.87	1.72	2.13	2.19	2.25	2.15	2.23	2.62
1905–06	$3.87	$2.94	$2.85	$2.78	$3.03	$3.17	$3.28	$3.47	$3.79	$4.46	$4.44	$4.60
1906–07	6.21	2.33	2.43	2.44	2.42	2.37	2.33	2.44	2.54	2.75	4.02	4.98
1907–08	2.46	3.09	2.57	2.97	2.83	2.52	2.11	2.01	1.84	1.66	1.69	1.89
1908–09	5.25	2.24	2.36	2.44	2.70	3.03	3.50	3.90	4.24	4.62	4.77	5.25
1909–10	3.35	2.78	2.54	2.71	2.87	2.72	2.72	2.71	2.77	2.83	3.49	3.71
1910–11	....	2.31	2.40	2.82	3.26	3.37	3.46	3.72	4.09	4.40	4.75	4.81
1911–12	4.83	1.95	1.94	2.31	2.29	2.34	2.46	2.49	2.52	2.97	3.31	3.49
1912–13	7.25	2.00	2.01	2.35	2.16	2.12	2.03	2.29	2.29	2.20	2.63	3.86
1913–14	....	2.69	2.80	2.97	3.19	3.33	3.62	3.99	4.02	4.09	4.96	5.58
1914–15	....	1.95	1.56	1.78	1.73	2.25	1.98	1.91	2.07	2.37	2.98	4.05
Yearly average 1879–1915	$3.09	$2.36	$2.35	$2.36	$2.46	$2.54	$2.66	$2.78	$2.80	$3.08	$3.54	$3.70
Yearly average 1879–1885	$3.03	$2.67	$2.56	$2.41	$2.63	$2.70	$2.70	$2.81	$2.90	$3.21	$3.93	$3.98
Yearly average 1885–1895	$2.63	$2.39	$2.48	$2.28	$2.36	$2.43	$2.63	$2.76	$2.86	$3.03	$3.49	$3.26
Yearly average 1895–1905	$2.35	$2.08	$2.11	$2.22	$2.27	$2.38	$2.56	$2.67	$2.80	$2.90	$3.20	$3.35
Yearly average 1905–1915	$4.75	$2.43	$2.35	$2.56	$2.65	$2.72	$2.75	$2.89	$3.02	$3.24	$3.70	$4.22

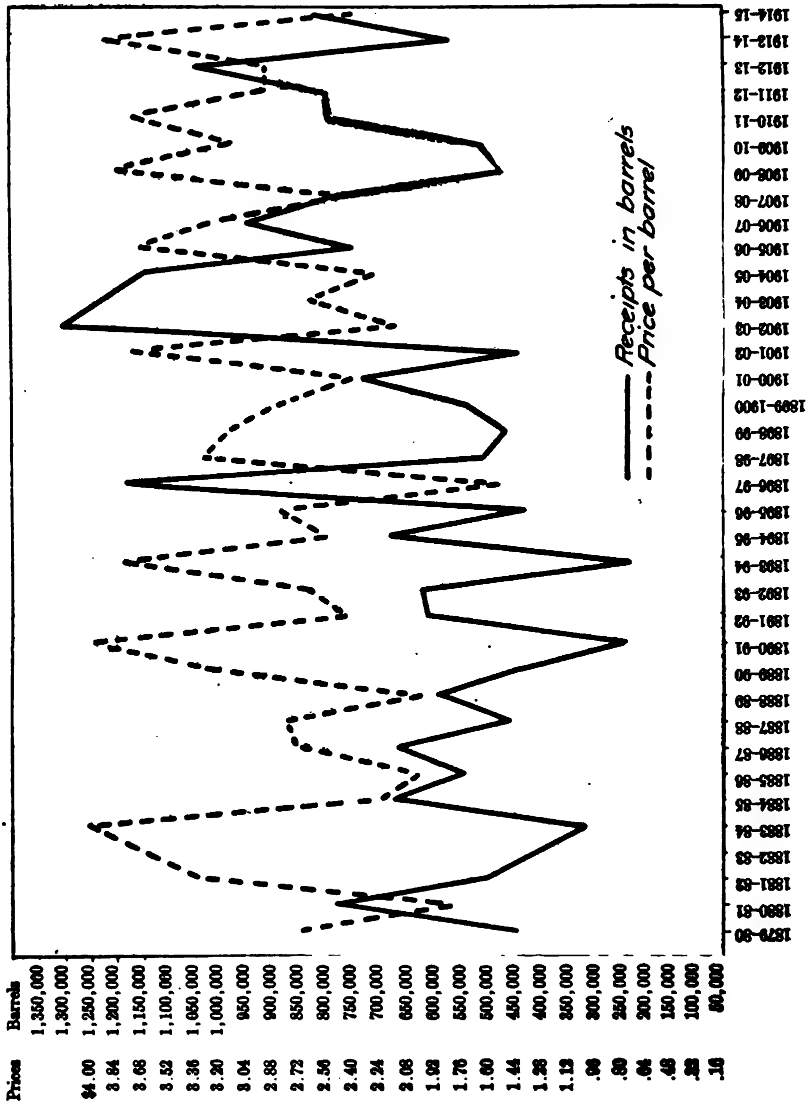

FIG. 71. DIAGRAM SHOWING YEARLY RECEIPTS IN BARRELS AND PRICE PER BARREL OF APPLES ON THE BOSTON MARKET

TABLE 4. AVERAGE PRICES OF APPLES IN BOSTON FOR THIRTY-SIX YEARS

	Total receipts	Total value	Average price per barrel	
1879–80	397,313	$1,023,512	$2.58	
1880–81	735,251	1,058,697	1.44	
1881–82	449,973	1,396,032	3.10	$2.66
1882–83	353,176	1,109,727	3.14	
1883–84	260,445	959,782	3.69	
1884–85	621,043	1,261,388	2.03	
1885–86	496,164	897,197	1.81	
1886–87	618,996	1,237,344	2.00	
1887–88	402,064	941,004	2.34	
1888–89	545,393	1,032,062	1.89	
1889–90	384,523	1,088,648	2.83	2.42
1890–91	190,934	741,982	3.89	
1891–92	568,105	1,072,988	1.89	
1892–93	575,114	1,401,074	2.44	
1893–94	174,989	541,338	3.09	
1894–95	684,854	1,391,912	2.03	
1895–96	378,783	902,635	2.38	
1896–97	1,131,147	1,439,514	1.27	
1897–98	465,551	1,375,130	2.95	
1898–99	418,021	1,098,267	2.63	
1899–1900	497,535	1,160,706	2.33	2.33
1900–01	686,440	1,350,122	1.97	
1901–02	397,233	1,364,799	3.44	
1902–03	1,259,285	2,440,368	1.94	
1903–04	1,189,738	2,919,084	2.45	
1904–05	1,105,527	2,148,128	1.92	
1905–06	708,546	2,201,546	3.11	
1906–07	909,503	2,269,405	2.50	
1907–08	750,421	1,869,431	2.49	
1908–09	423,257	1,210,246	2.86	
1909–10	464,887	1,290,903	2.78	2.67
1910–11	760,353	2,377,226	3.13	
1911–12	767,714	1,797,663	2.34	
1912–13	1,010,635	2,284,489	2.26	
1913–14	531,361	1,728,103	3.27	
1914–15	787,678	1,532,388	1.95	

TABLE 5. AVERAGE PRICES OF DIFFERENT VARIETIES

Year	Wealthy Sept.-Nov.	Williams Aug.-Sept.	Twenty Ounce Sept.-Nov.	Roxbury Russet Nov.-July	Tompkins King Oct.-April	Baldwin Oct.-June	Pound Sweet Sept.-Dec.	Rhode Island Sept.-May	Fameuse Oct.-Dec.	Ben Davis Oct.-June	Alexander Sept.-Nov.	Northern Spy Nov.-June	Hubbardston Oct.-Jan.
1876–77	......	......	......	......	......	......	......	......	......	......	......	......	......
1877–78	......	......	......	$4.12	......	$4.43	......	$3.93	......	......	......	......	......
1878–79	......	......	......	2.04	......	1.34	......	1.07	......	......	......	......	$1.27
1879–80	......	$3.00	......	3.22	......	2.83	$1.59	2.35	$2.77	......	......	......	2.43
1880–81	......	1.03	......	2.48	......	1.53	1.58	1.10	......	......	......	......	1.29
1881–82	......	2.98	......	5.03	......	2.93	2.92	2.87	3.40	......	......	......	2.55
1882–83	......	2.79	......	5.00	......	3.49	3.00	3.24	3.38	......	......	......	2.68
1883–84	......	5.00	......	4.63	......	3.87	3.45	3.73	......	......	......	......	3.65
1884–85	......	2.19	......	2.69	......	2.12	2.06	1.81	3.04	......	......	......	1.83
Average	......	$2.83	......	$3.65	......	$2.82	$2.43	$2.51	$3.15	......	......	......	$2.24
1885–86	......	$2.32	$1.72	$2.35	$2.02	$1.51	$1.65	$1.47	$2.24	......	......	......	$1.67
1886–87	......	1.85	1.83	3.59	2.15	2.46	2.00	2.22	3.04	......	......	$2.61	1.63
1887–88	......	2.54	2.07	3.50	2.82	2.72	......	2.08	2.82	......	......	2.74	2.16
1888–89	......	2.44	2.03	2.11	2.03	1.24		1.22	3.46	......	......	......	1.37
1889–90	......	3.25	......	4.56	3.25	3.04	3.09	2.81	3.25	......	......	3.75	2.38
1890–91	......	4.50	3.71	4.50	5.24	4.19	4.17	3.59	4.27	......	......	5.00	3.12
1891–92	......	1.89	1.83	2.84	2.16	1.91	1.74	1.49	2.18	......	......	......	1.82
1892–93	......	2.54	......	2.64	2.85	2.34	2.23	2.49	2.50	......	......	2.81	2.13
1893–94	......	2.25	2.87	4.64	......	3.99	......	2.87	3.69	......	......	......	2.42
1894–95	......	2.13	1.78	2.98	2.65	2.49	1.74	1.91	2.25	......	......	......	1.67
Average	......	$2.57	$2.23	$3.37	$2.80	$2.59	$2.37	$2.22	$2.97	......	......	$3.38	$2.04
1895–96	......	$2.60	$1.66	$3.61	$3.35	$3.00	$2.25	$2.33	$2.75	$2.37	......	......	......
1896–97	......	1.34	1.24	2.12	1.50	1.11	1.35	.87	1.73	......	$1.62	$1.59	$.99
1897–98	......	2.42	2.25	3.51	3.16	3.39	2.75	3.12	3.00	3.31	2.33	......	......
1898–99	......	2.03	......	3.69	3.38	3.19	2.83	2.81	2.68	......	......	4.11	2.22
1899–1900	......	2.38	2.06	3.87	2.75	3.11	2.22	2.23	2.75	3.45	......	4.50	......
1900–01	$2.10	1.59	1.84	3.20	2.53	2.33	1.64	1.88	2.15	3.12	1.90	2.84	1.74
1901–02	3.20	2.82	2.70	4.42	4.43	4.06	3.08	3.75	3.20	3.71	3.34	3.81	......
1902–03	2.30	1.63	1.78	2.18	2.50	1.80	1.62	1.61	2.30	1.88	......	1.97	1.64
1903–04	2.57	2.67	2.19	2.63	3.26	2.01	2.06	2.35	2.58	2.10	2.90	2.72	......
1904–05	2.00	1.94	1.77	2.28	2.88	2.09	1.59	1.63	1.86	1.55	2.03	2.61	1.50
Average	$2.43	$2.14	$1.95	$3.15	$2.97	$2.61	$2.14	$2.26	$2.50	$2.81	$2.35	$3.02	$1.62
1905–06	$2.78	$2.96	$2.55	$4.46	$3.88	$3.73	$2.78	$3.30	$2.65	$4.11	$3.12	$4.29	......
1906–07	2.35	2.38	2.31	4.32	2.93	3.55	2.42	2.01	2.59	2.55	2.69	3.66	......
1907–08	2.36	3.09	2.29	1.57	3.30	2.44	2.34	2.12	2.67	1.36	3.16	2.04	......
1908–09	2.02	2.31	......	3.76	3.63	4.23	2.76	3.29	2.69	3.30	2.77	3.59	$2.25
1909–10	2.75	2.92	2.75	2.96	3.30	3.31	2.62	2.75	2.81	2.60	3.01	2.92	2.23
1910–11	3.00	2.36	......	3.69	4.10	3.99	2.63	3.43	3.28	3.74	3.00	4.07	2.62
1911–12	2.24	2.16	......	3.23	3.04	2.72	2.22	2.28	2.45	2.78	2.48	4.05	......
1912–13	2.26	2.06	2.22	2.71	2.68	2.98	2.17	2.25	2.02	1.86	2.50	3.11	1.78
1913–14	2.94	3.01	3.00	3.60	3.94	4.46	3.12	3.30	3.35	3.08	3.00	4.09	2.83
1914–15	1.88	1.89	1.80	1.74	2.47	2.42	1.87	1.96	2.21	1.77	1.82	2.85	1.62
Average	$2.46	$2.51	$2.42	$3.20	$3.33	$3.38	$2.49	$2.67	$2.67	$2.72	$2.76	$3.47	$2.22

Year	Tolman Nov.-April	Wolf River Sept.-Nov.	Astrachan July-Sept.	Sweet Bough July-Aug.	Harvey (Maine) Sept.-Nov.	Gravenstein Aug.-Oct.	Gravenstein (Nova Scotia) Oct.-Nov.	McIntosh Oct.-Dec.	Oldenburg Aug.-Sept.	Norfolk July	Crab apples Sept.-Oct.	Box crab apples Sept.-Oct.	Gravenstein (box) Sept.-Oct.
1876–77	...	...	...	...	...	...	...	...	...	...	...	...	...
1877–78	...	...	...	$2.75	...	...	...	...	...	$2.87	...	...	...
1878–79	$2.29	...	...	2.60	...	$2.17	...	...	...	2.93	...	...	...
1879–80	2.92	...	...	1.55	$2.21	2.75	...	...	...	2.58	...	...	...
1880–81	1.70	...	...	1.84	...	1.45	...	...	...	1.83	...	...	...
1881–82	3.34	...	...	2.70	3.18	3.32	...	...	...	4.00	...	...	...
1882–83	3.65	...	...	4.28	...	3.67	$2.78	...	...	3.59	...	...	...
1883–84	3.37	...	...	3.50	...	4.88	4.53	...	...	2.82	...	...	...
1884–85	1.82	...	...	2.13	1.93	2.34	2.32	...	...	2.50	...	...	...
Average	$2.74	...	...	$2.67	...	$2.94	...	...	...	$2.89	...	...	...
1885–86	$1.81	...	$2.40	$2.07	$1.95	$2.73	$2.25	...	...	$2.00	...	...	...
1886–87	2.27	...	2.42	2.71	1.94	1.69	2.02	...	...	2.35	...	...	...
1887–88	...	...	2.31	2.28	2.00	2.86	...	...	...	2.94	...	...	...
1888–89	1.65	...	2.33	2.38	1.89	2.42	2.09	...	...	2.75	...	...	...
1889–90	2.89	...	3.38	...	2.85	3.54	2.82	...	...	3.27	...	...	...
1890–91	3.25	...	3.88	4.33	4.25	4.69	4.22	...	...	2.33	...	...	...
1891–92	1.77	...	1.58	1.50	1.80	2.65	2.34	...	...	3.67	...	...	...
1892–93	2.16	...	1.92	2.38	2.48	2.98	...	...	...	1.95	...	...	...
1893–94	3.70	...	3.00	2.53	3.20	3.20	...	...	...	...	...	...	...
1894–95	1.75	...	1.53	1.59	1.67	2.00	...	...	...	1.50	...	...	...
Average	$2.36	...	$2.48	$2.42	$2.40	$2.88	$2.62	...	...	$2.53	...	...	...
1895–96	$2.46	...	$1.90	$2.17	$2.00	...	$2.48	...	...	$1.75	...	...	...
1896–97	1.33	...	1.59	1.79	1.07	$1.58	1.81	...	$1.19	2.60	...	...	...
1897–98	...	...	2.09	2.50	2.66	3.49	...	...	2.75	2.60	...	...	...
1898–99	2.48	...	1.53	2.17	...	2.63	2.84	...	2.28	...	...	...	...
1899–1900	2.03	...	2.06	2.00	1.88	2.57	3.10	...	2.21	...	...	...	...
1900–01	2.04	...	1.28	1.54	1.62	2.20	2.05	$2.25	1.61	...	...	...	...
1901–02	3.00	...	2.29	2.61	3.42	3.65	3.75	...	2.98	...	...	...	...
1902–03	1.87	...	1.74	2.31	1.88	2.37	...	...	1.54	1.75	...	...	...
1903–04	1.89	...	2.20	2.23	2.37	3.39	...	3.20	2.26	...	...	...	...
1904–05	1.88	...	2.32	2.61	1.62	2.32	...	2.67	1.56	2.13	...	...	...
Average	$2.11	...	$1.90	$2.19	$2.06	$2.69	$2.67	...	$2.04	$2.17	...	...	...
1905–06	$2.60	...	$2.58	$2.96	$2.94	$3.41	...	$3.75	$2.74	$3.33	$2.00	...	...
1906–07	2.15	$2.97	1.97	2.44	2.37	3.25	...	3.09	2.07	...	1.93	...	$3.75
1907–08	1.45	3.31	2.54	2.63	2.86	3.61	...	2.50	2.55	...	2.90	...	...
1908–09	3.03	2.94	1.93	2.13	2.26	2.84	$2.79	3.93	2.32	...	1.60	...	...
1909–10	2.50	2.96	2.48	3.25	2.87	3.58	2.75	3.88	2.85	2.25	2.25	$3.75	...
1910–11	2.89	3.25	1.93	...	2.78	2.98	...	4.29	2.17	...	2.55	3.09	...
1911–12	2.01	2.46	1.88	1.91	2.10	2.75	2.35	3.05	2.20	...	2.07	2.25	3.00
1912–13	1.94	2.65	1.81	2.05	2.18	2.79	...	3.23	2.19	...	2.62	3.30	3.93
1913–14	3.80	3.00	2.67	3.13	2.97	3.81	...	3.95	2.66	...	3.60	5.25	4.71
1914–15	2.05	1.82	1.72	2.16	1.66	2.16	1.97	2.98	1.75	...	2.04	2.22	2.91
Average	$2.44	$2.82	$2.15	$2.52	$2.50	$3.12	$2.47	$3.38	$2.35	...	$2.36	$3.30	$3.66

TABLE 6. AVERAGE PRICES OF VARIETIES BY MONTHS

Variety	July	August	September	October	November	December	January	February	March	April	May	June
1879–80 to 1884–85												
Norfolk	$3.06	$2.62										
Gravenstein			$2.94	$2.86								
Baldwin				2.02	$2.18	$2.37	$2.64	$2.99	$3.01	$3.23	$3.51	
Rhode Island				1.81	2.23	2.42	2.35	3.11				
Sweet Bough	2.53	3.07										
Williams		2.91										
Russett	4.50								2.37	3.16	3.75	$4.18
Hubbardston			1.79	1.99	2.37	2.23						
Tolman					2.89	2.86	2.76	2.46				
Fameuse				3.18	3.17							
Pound Sweet*				2.31	2.68							
1885–86 to 1894–95												
Norfolk	$2.59											
Gravenstein		$2.91	$2.70	$2.91	$2.78							
Harvey (Maine)			3.36	2.42	2.34							
Baldwin				1.95	2.00	$2.20	$2.51	$2.73	$2.96	$3.08	$3.19	
Tompkins King				2.18	2.74	2.99	3.13					
Rhode Island				2.12	2.05	2.19	2.29	2.21	2.09			
Astrachan	2.75	2.29										
Sweet Bough	2.31	2.38										
Twenty Ounce			2.38	2.87	1.99							
Williams		2.55	2.22									
Northern Spy								2.83	3.50	3.75		
Russett									3.59	3.15	3.41	$3.60
Hubbardston				1.95	2.15	1.98						
Tolman					2.41	2.39	2.48	2.53	2.13	1.97		
Fameuse				2.71	2.84	3.05						
Pound Sweet				2.15	2.30							
Gravenstein (Nova Scotia)				2.66	2.56							
1895–96 to 1904–05												
Norfolk	$2.17											
Alexander			$2.61	$2.40								
Gravenstein		$2.31	2.62	3.06								
Harvey (Maine)			2.62	2.06	$2.04							
Oldenburg		2.18	1.98									
Baldwin				2.01	2.13	$2.34	$2.57	$2.70	$2.81	$2.95	$3.14	
Tompkins King				2.52	2.79	2.90	3.16	3.27	2.95			
Ben Davis				2.53	2.63	2.53	2.87	2.96	3.08	2.77	2.96	$2.62
Rhode Island				1.93	2.02	2.22	2.37	2.42	2.66	2.20		
Astrachan	2.38	1.76	1.34									
Sweet Bough	2.45	2.12										
Twenty Ounce			1.87	1.97	1.92							
Williams		2.15	2.28									
Northern Spy					2.26	2.32	2.53	3.01	2.96	2.78	3.63	2.92

Russett										2.92	3.13	3.41
Hubbardston				1.53	1.58	1.74						
Tolman					2.07	2.05	2.09	2.15	2.07	2.27		
Fameuse				2.42	2.48	2.43	3.50					
Wealthy				2.45	2.50							
Pound Sweet			1.73	2.08	2.15	2.23						
Gravenstein (Nova Scotia)				2.72								
1905–06 to 1914–15												
Norfolk												
Alexander			$2.64	$2.83	$2.57							
Gravenstein		$2.68	3.08	3.37								
Harvey (Maine)			2.56	2.50	2.56							
Oldenburg		2.49	2.31									
Crab apples	$2.36		1.94	2.43								
Box crab apples	3.30		2.76	3.39								
Gravenstein (box)	3.66		3.33	4.17								
Baldwin	5.73			2.34	2.44	$2.65	$2.88	$3.05	$3.26	$3.59	$4.12	$4.91
Tompkins King				2.88	3.21	3.29	3.39	3.45	3.52	3.02		
Ben Davis					1.91	2.38	2.46	2.42	2.63	2.84	2.96	3.03
Rhode Island				2.38	2.35	2.61	2.70	2.94	2.66	2.57		
Astrachan		2.24	1.98									
Sweet Bough	3.01	2.41										
Twenty Ounce			2.23	2.43	2.25							
Williams		2.49	2.81									
Northern Spy	5.25				2.57	2.83	2.99	3.03	3.32	3.41	3.92	4.61
Russett	4.26							2.56	2.93	3.10	3.67	3.95
Hubbardston				2.04	2.26	2.45	2.18					
Tolman					2.21	2.43	2.44	2.10	2.20	2.02		
Wealthy			2.23	2.55								
Fameuse				2.64	2.77	2.61						
Pound Sweet			2.57	2.49	2.59	2.54						
McIntosh				3.36	3.59	3.48						
Gravenstein (Nova Scotia)				2.47								
Wolf River			2.57	2.91	2.75							

* Pound Sweet, 1876–77 to 1884–85.

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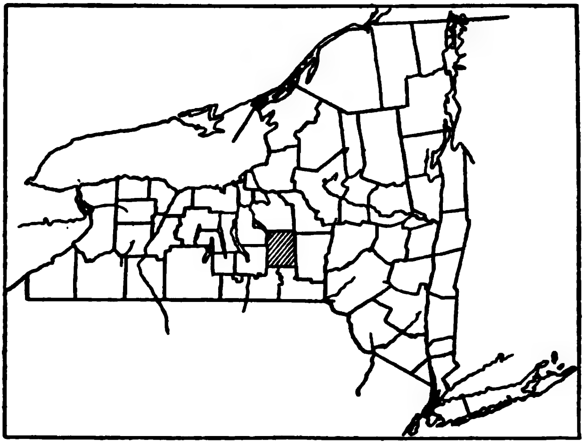
Soil Survey of Cortland County
New York



The shaded part shows the location of the surveyed area

E. T. Maxon, of the U. S. Department of Agriculture, and
G. L. Fuller, of the New York State College of Agriculture

Under the direction of
Elmer O. Fippin

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RESOLUTION PROVIDING FOR THE FEDERAL PUBLICATION AND DISTRIBUTION OF SOIL SURVEY REPORTS

[Public Resolution — No. 9]

JOINT RESOLUTION amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

EXPLANATORY STATEMENT

The subjoined is a report on the Soil Survey of Cortland County, accompanied by a large-scale map in colors showing the distribution of the several types of soil recognized and described. This survey was made by E. T. Maxon, representing the Bureau of Soils of the United States Department of Agriculture, and G. L. Fuller, representing the Department of Soil Technology of this College. The work was done in cooperation with the United States Bureau of Soils, of which Milton Whitney is Chief, Curtis F. Marbut is in charge of Soil Survey, and W. E. McLendon is Inspector of the Northern Division. A limited edition of this report is published by the United States Department of Agriculture as a separate from the Field Operations of the Bureau of Soils, but this College has none of these reports for distribution.

A. R. MANN,
Dean.

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FIGURE

MAP

SOIL SURVEY OF CORTLAND COUNTY, NEW YORK

By E. T. MAXON, of the U. S. Department of Agriculture, In Charge, and G. L. FULLER, of the New York State College of Agriculture.—Area Inspected by W. E. McLENDON

DESCRIPTION OF THE AREA

Cortland County is situated in the central part of New York, about halfway between the cities of Syracuse and Binghamton. It is bounded on the north by Onondaga County, on the east by Madison and Chenango Counties, on the south by Broome and Tioga Counties, and on the west by Tompkins and Cayuga Counties. The county is rectangular in outline, its dimensions being approximately 25 miles from north to south and 20 miles from east to west. It embraces an area of 503 square miles, or 321,920 acres.

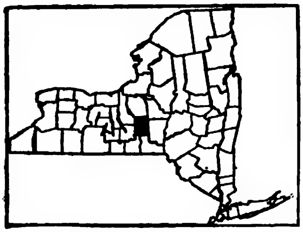

FIG. 72. Sketch map showing location of the Cortland County area, New York

Cortland County lies in the Allegheny Plateau, an elevated area occupying the southern part of the State and extending thence southward. The elevation of this plateau ranges from about 1,500 feet to 4,000 feet above sea level. In Cortland County it lies at about 1,800 feet, the higher points in the northern part of the county lying a little higher than this, and the greater part of the southern end lying a little lower.

The plateau is so thoroughly dissected that no areas of level land unaffected by the erosion of the dissecting cycle remain. The depth of the dissection is much greater than that of the greater part of the area of the United States in the same stage of development. The valleys of the larger streams, those that can be accepted as furnishing a base for measuring the depth of dissection, lie at an elevation ranging from about 1,100 feet or a little less to a little more than 1,200 feet. The depth of dissection, therefore, is about 600 feet. While the dissection is both thorough and deep it is not sharp. Stony cliffs are of very rare occurrence. The slopes are rounded so that the profiles are smooth, flowing curves rather than angular. Access to all parts of the area is possible, though the depth of the valleys makes movement over the region difficult on account of the amount of lift entailed rather than because of the steepness of the slopes. A few

miles north of the northern boundary of Cortland County the plateau drops to a level of less than 1,000 feet in a series of steps.

The plateau of Central New York is traversed by a series of relatively broad valleys extending from the lowland north of the plateau southward across or through it to the valley of the Susquehanna River along the southern border of the State. These broad valleys have no relation to the existing drainage except to exercise almost complete control over it rather than being themselves controlled by it. The larger creeks flowing into the Susquehanna and Delaware Rivers, as well as those flowing northward into the Great Lakes, rise within these valleys, the watersheds lying on the valley floors with no visible ridges to mark their location. Cortland County lies immediately south of the watershed in many of these large valleys, the northern boundary lying within a mile or so of some of them. The small streams occupy these large valleys in a wholly misfit way.

The northern part of the county is traversed by several large valleys, all converging into one at Cortland, and six of them extending northward as deep, wide valleys across the watershed into the basins of northward flowing streams. The southeastern part of the county is traversed by three valleys of the same kind though somewhat narrower, each with several branches, most of which extend across the watershed into the drainage basins of the northern part of the county and some extending beyond the county line and northeastward across the Great Lakes-Susquehanna watershed.

The broadest of these valleys are the Homer Valley in the northern part of the county, running north and south past Cortland; the Otselic, across the southeastern part of the county; and the Harford, across the southwestern part.

Owing to the rolling topography and the numerous draws and small streams, the run-off is large. The larger streams have sufficient gradient to carry all the drainage, except at times of unusually heavy precipitation. The drainage of the central and northern parts of the county is carried by the Tioughnioga River and that of the southeastern corner by the Otselic River. Both of these rivers are tributary to the Susquehanna. The northwestern part of the county drains into Skaneateles Lake, and the region tributary to Virgil Creek in the western part into Cayuga Lake. The drainage of the extreme southwestern corner flows into Owego Creek, also a part of the Susquehanna drainage system. A few poorly drained areas occur in the bottom lands along the streams. Water power for sawmills and gristmills has been developed from many of the swifter flowing streams throughout the county.

The first settlement in the territory embraced in Cortland County was made in 1791, near the site of the present village of Homer, much of the remaining territory being taken up during the ensuing

10 years.[1] The pioneers came from the New England States and from the earlier settled regions to the east. Cortland County was formed from a part of Onondaga County in 1808. At present it comprises 15 townships. The population is densest in the western part of the county, especially along the valleys. The total population, according to the 1910 census, is 29,249, of which 51.5 per cent is classed as rural. The population averages nearly 30 persons to the square mile. Cortland, the county seat and largest city, with a population in 1910 of 11,504, is a growing manufacturing city. Homer, with a population of 2,695; Marathon, with 1,075; and McGraw, with 931, rank next. Other villages of local importance are Cincinnatus, Truxton, Harford, Preble, Willet, Little York, and Cuyler.

Transportation facilities are excellent, all sections of the county being within 7 miles of a steam railroad. The Binghamton, Syracuse, and Oswego division of the Delaware, Lackawanna & Western Railroad traverses the western part of the county from north to south, and the Cincinnatus branch of this line extends easterly from Cortland to Cincinnatus. One branch of the Lehigh Valley Railroad crosses the county in a northeasterly direction from a point southwest of Cortland, and another branch crosses the southwest corner. An electric railroad runs from Cortland to McGraw, in the central part of the county, and from Cortland to Preble, in the northern part. All the railroads in the county, except one branch, pass through Cortland. There are about 100 miles of improved State roads and 1,000 miles of dirt roads. The dirt roads are usually kept in good repair. All parts of the county are well supplied with schools and churches and have telephone and rural mail-delivery service.

Cortland is the principal market and distributing center. New York, Philadelphia, Baltimore, Pittsburgh, Scranton, and Wilkes-Barre are the more important outside markets.

CLIMATE

Cortland County has the characteristic climate of southern New York. The winters are of about 5 months' duration and moderately severe, while the summers are warm, with occasional short periods of high temperature. The mean temperature for the months of November, December, January, February, and March is 27.5° F., and that for the three summer months, June, July, and August, is 65°. The lowest temperature recorded is —29°, in January, and the highest 96°, in July and August. The mean annual temperature is 44.6°.

The rainfall is sufficient for the common crops. April and May have an average precipitation of 2.97 and 3.95 inches, respectively,

[1] History of Cortland County, by H. P. Smith.

while the mean for June, July, and August is 12.84 inches. Usually the summer rainfall is well distributed.

The average dates of the last killing frost in spring and the first in fall are May 18 and October 2. This gives a growing season of 137 days, the grazing season for dairy cattle lasting 3 to 4 weeks longer. The extreme recorded dates of killing frost in the spring and fall are June 6 and September 15.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation as recorded at the Weather Bureau station at Cortland, 1,112 feet above sea level.

Normal monthly, seasonal, and annual temperature and precipitation at Cortland

Month	Temperature			Precipitation		
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year	Total amount for the wettest year
	°F.	°F.	°F.	Inches	Inches	Inches
December	26.2	60	−13	3.06	3.98	3.29
January	22.8	68	−29	2.63	1.88	3.02
February	22.0	61	−23	2.35	0.69	2.05
Winter	23.7	68	−29	8.04	6.55	8.36
March	30.5	80	−12	2.69	1.83	2.58
April	42.5	92	10	2.97	0.56	6.78
May	54.5	91	23	3.95	2.50	4.38
Spring	42.5	92	−12	9.61	4.89	13.74
June	62.9	92	31	4.28	2.25	12.55
July	67.1	96	36	4.81	4.69	2.30
August	65.0	96	35	3.75	2.64	5.40
Summer	65.0	96	31	12.84	9.58	20.34
September	57.9	92	27	3.42	2.40	4.45
October	47.1	85	18	3.86	2.99	4.88
November	36.2	70	0	3.09	2.99	3.48
Fall	47.1	92	0	10.37	8.38	12.81
Year	44.6	96	−29	40.86	29.40	55.25

AGRICULTURE

The early settlers found this region heavily forested with maple, beech, elm, basswood, pine, hemlock, and cherry, with chestnut, oak, white ash, and birch on the higher hills. Their first efforts were directed toward clearing the land and growing subsistence crops. The most important commercial products were wood ashes or black salts,

maple sugar, and pottery, which were shipped down the Tioughnioga River during periods of high water. The settlers early recognized the adaptability of this section to dairying, which became the most important industry. As early as 1855 the county produced 2,379,257 pounds of butter, as well as a large quantity of cheese.

Dairying continues to be the main industry, although butter and cheese making have been largely displaced by the sale of milk. Most of the milk is sent to New York City, although a considerable quantity is hauled to Cortland for manufacture into milk products. Every railroad station in the county has a milk depot, to which farmers haul their milk daily. The dairy stock is carefully housed and modern equipment is used. The Holstein is the predominating breed of dairy cattle, followed by the Jersey, Guernsey, and Ayrshire. Many herds are composed altogether or in part of purebred stock. According to the census, there were 43,239 cattle in the county in 1910, of which 27,427 were dairy cows. In 1901 there were produced 13,740,015 gallons of milk, 144,343 pounds of butter, and 165 pounds of cheese. Dairy products, excluding milk and cream used at home, were valued at $1,595,671.

Sheep formerly were kept in large numbers on the hill farms, but owing to the low price of wool and mutton and the difficulty of protecting the animals from dogs, very few are kept at present. In 1910 there were only 3,616 sheep in the county. These were valued at $20,773. On nearly every farm a few hogs are raised for home consumption. In 1910 the number reported was 5,233, valued at $43,801. Every farmer keeps some poultry for home use, the excess products being sold. The census reports poultry and eggs to the value of $233,909 sold in 1909. The total value of domestic animals, poultry, and bees in the county in 1910 was $2,762,215.

Oats, corn, and hay have been the principal crops since the early settlement of the county. In 1879 oats were grown on 12,439 acres, with a production of 416,175 bushels, and in 1909 on 13,028 acres, with a production of 396,974 bushels, or an average of 30.4 bushels per acre. Most of this crop is utilized on the farm as horse feed.

In 1879 the area devoted to corn amounted to 5,373 acres, from which 185,979 bushels of grain were produced, while in 1909 only 1,852 acres of this crop were grown, with a production of 74,105 bushels. Much of the land formerly used for this grain is now used for producing corn for ensilage. Corn does well throughout the county, although the growing season is sometimes too short to mature the grain. Yields of ensilage corn range from 8 to 17 tons per acre, the largest yields being obtained on the valley farms.

Every farmer devotes a large acreage to hay and forage crops. In 1909 timothy and clover mixed were grown on 51,741 acres, from which 58,370 tons of hay were produced; timothy alone on 9,292 acres,

producing 11,146 tons; and clover on 412 acres, from which 845 tons were produced. Miscellaneous grasses and forage crops, including alfalfa, millet, and other tame or cultivated grasses, grains cut green, and coarse forage, were grown on 19,199 acres, producing 59,503 tons. A large proportion of the hay produced is fed on the farm, the remainder being baled and sold at the local markets. The total value of hay and forage crops produced in 1909 was $1,118,894.

In 1879 buckwheat was grown on 1,510 acres, producing 22,493 bushels, as compared with an area of 4,625 acres and a production of 110,793 bushels in 1909, averaging 23.9 bushels per acre. This crop is widely grown throughout the county, being especially well adapted to the hill land. It is a cash crop, very little being utilized on the farms.

In 1909 there were 893 acres devoted to barley, producing 24,348 bushels, or an average of 27.2 bushels per acre. Much of this crop is fed on the farm. Very little wheat and rye are grown.

The area in potatoes increased from 2,979 acres in 1879 to 4,961 acres in 1909. In the latter year the production amounted to 750,187 bushels, or an average of 151.2 bushels per acre. Potatoes are one of the important cash crops, and are largely grown on the hill farms, where the soil is well adapted to their production. Most of the crop is shipped outside the county. The principal varieties of potatoes are the Rural New Yorker, World's Superior, Green Mountain, and Number Nine.

Cabbage is grown extensively, especially in the valleys throughout the northern part of the county, for shipment to the big markets in the fall and winter. Late cabbage of the Danish variety is usually grown. In the western and northwestern parts of the county peas, beans, greens, and sweet corn are grown for canning factories.

The census reports 184,402 maple trees tapped in 1909, with a production of 113,332 pounds of sugar and 41,038 gallons of sirup. The trees are scattered through all parts of the county. Most of the product is sold.

Every farm has a few fruit trees, mainly apple, and there are a few commercial orchards. In 1909 there were 131,575 bushels of apples, 20,316 pounds of grapes, 35,340 quarts of strawberries, 31,691 quarts of raspberries and loganberries, and 52,275 pounds of nuts produced in the county. The value of the fruit and nut production was $66,385.

The farmers generally recognize the crop adaptation of certain soils. The hardpan soils of the Volusia series are considered best suited to grasses, the well-drained soils of the Lordstown and Wooster series to potatoes, and the gravelly soils of the valleys, embraced in the Fox and Chenango series, to ensilage corn. Buckwheat is

considered the most suitable crop for the poorer soils. Alfalfa does best on the Fox and Ontario soils.

Grain crops usually are thrashed at the barn, the straw being placed under cover or stacked for use during the winter. Hay is generally stored in large barns. The potato crop is either sold directly from the field or stored in cellars to be sold at a later date. Cabbage is harvested in the fall and either stored on the farm or hauled to town for storage or shipment.

The farmhouses usually are large and substantial, with well-kept lawns. On dairy farms there is usually a barn with basement room sufficient to stanchion 10 to 50 or more cows, haymows of 75 to 150 tons capacity, one or two silos of 100 tons or more capacity, granaries, and tool rooms. There are usually additional buildings for housing wagons, implements, hogs, and poultry. Modern machinery is in common use, including two-way riding plows, harrows, corn and grain drills, potato and cabbage planters, sprayers, corn cutters, mowing machines, hay loaders, reapers, binders, ensilage cutters, potato diggers, and milking machines.

The work stock consists almost exclusively of horses. These are medium-sized chunks averaging about 1,150 pounds in weight. Three or more horses are used for the heavier work. Tractor engines are not extensively used. In 1910 the value of all property per farm was $5,046, of which 37.3 per cent was represented by land, 34.9 per cent by buildings, 6.8 per cent by implements, and 21 per cent by domestic animals.

The rotation most commonly practiced on the dairy farms consists of cabbage or potatoes for one year and corn one year, followed by oats sown with timothy and clover. The sod is mowed from 2 to 10 years, the best farmers turning it under in 2 or 3 years. As a rule the first cutting is clover, with timothy the succeeding years.

In 1909, 1,779 farms used commercial fertilizer at a total cost of $73,448, or $41.29 each. Commercial fertilizer is usually applied to corn, potatoes, and cabbage. For corn an acreage application of 250 to 300 pounds of a 3–9–2 mixture is commonly made, and for potatoes from 500 to 1,000 pounds of a 2–8–10 mixture. A 2–8–10 mixture is also used by some farmers for oats. There is much reason to believe that fertilizer containing one-third to one-half as much potash as this formula contains will give quite as good results. Nearly every farmer utilizes the barnyard manure, spreading it either on sod land or on corn stubble. Lime is widely used, the applications ranging from 500 to 2,000 pounds per acre. It is usually applied on plowed land for all crops except potatoes.

Reliable farm laborers are scarce. Monthly wages range from $25 to $45, with house and garden, and day wages from $1.75 to $2.50.

In 1910 there were 2,610 farms in the county, representing 93.1 per cent of the total land area. The number of farms has been gradually decreasing for many years, the smaller places being absorbed by larger ones. The farms range in size from 3 to over 1,000 acres, the average size being 114.8 acres.

Owners operated 78.3 per cent of the farms in 1910, as compared with 70.8 per cent in 1900. Farms are rented both for cash and on shares, the number of cash renters being slightly in excess of those renting on shares. In share renting the landlord furnishes half the seed and fertilizer and receives half the gross returns.

Land values vary with the location and improvement. The price of hill farms ranges from $10 to $45 an acre, with an average of $25, and that of valley farms from $35 to $150 an acre, with an average of about $75. The valley farms usually have good buildings and fences and are located on good roads.

SOILS

Cortland County is situated in the glacial region near the northern border of the Allegheny Plateau. The underlying consolidated rocks consist of light-colored shale and sandstone, with occasional lentils or thin layers of limestone.

The material from which nearly all the soils are derived owes its accumulation to the continental glacier which swept over this region in the late Wisconsin stage of glaciation. Upon the final retreat of the great ice sheet, which came from the north, the hills were left thinly mantled with glacial débris, while through the valleys deep morainal deposits, as well as extensive gravel plains, were built up, and fine sediments were deposited in lakes existing at the time. Materials of more recent deposition occupy stream flood plains and marshy and swampy areas where conditions have favored the accumulation of organic remains.

The thin mantle of till of the uplands is derived almost entirely from the local sandstone and shale formations. Only an occasional fragment of granite or other crystalline rock is to be found, and most of the stones are angular, indicating that they are not far removed from their source. The deep morainal deposits in the valleys are of more mixed origin. Some of the areas in the Cortland Valley and in other valleys converging with it from the northwest and northeast are very strongly influenced by limestone. Farther south there is little or no limestone in the till, but there is a greater abundance of crystalline gravel and other foreign rock material present than in the ground moraine blanketing the hills. Generally in the terminal moraine area there is considerable grit and gravel in the soil section and the substratum may be little else than beds of angular and rounded gravel, cobblestones, and sand.

The water-laid deposits now occurring as second bottoms or terraces are derived almost entirely from the local sandstone and shale rocks, except in the northern part of the county, where some important areas carry a high percentage of limestone material. Where the material was deposited under lake conditions it is heavy in texture from the surface downward and there is little or no stone present. The typical gravel terraces, however, consist of beds of gravel and sand, covered with a thin mantle of loamy material.

In the overflow lands no close distinction can be made on the basis of origin. It is probable that the areas associated with the calcareous terraces and morainal deposits are derived in part from limestone material, while those farther south are almost altogether derived from sandstone and shale, but in color, structure, and agricultural characteristics the first-bottom soils seem to be very much the same throughout the county.

The whole area of Cortland County was originally forested. The stand was thick, the trees large, and both pine and hardwoods were represented. The soils developed as podsols, therefore, with a relatively thin podsolized, or A, horizon. The illuvial, or B, horizon, the horizon in which the downward leached organic and mineral matter was deposited, lay but a few inches beneath the surface, so that on cultivation the brown B horizon, or at least its upper part, became mixed in plowing with the gray of the A horizon. As a result of this the soil as found in cultivated fields is brown. The subsoils are brown to yellowish, lighter in shade than the surface soils. The region is, therefore, a region of brown soils except where drainage is poor. Further differentiation is based on texture of soil and subsoil, drainage, oxidation, and origin of the soil material.

Soils similar in all respects except texture are grouped in series. In Cortland County 9 series, embracing 17 distinct types of soil, in addition to Meadow and Muck, are mapped. In the uplands two series, the Lordstown and Volusia, predominate. The deep till deposits in the valleys give rise to the Wooster series where the material is almost entirely of sandstone and shale origin, and to the Ontario series where there is a considerable admixture of limestone material. The gravelly terrace soils are included in the Chenango and Fox series and the heavier lake deposits, which are calcareous and have a peculiar brownish color, in the Schoharie series. The first bottoms are occupied by the Genesee and Holly series, and by Meadow. The organic soils are classed as Muck.

The surface soils of the Lordstown series are grayish brown to yellowish brown, while the subsoils are yellowish brown or light brownish yellow, and of about the same texture as the surface soils. Bedrock, consisting of sandstone and shale, is usually encountered at a depth of 1 to 3 feet and in places at 4 or 5 feet. This seri

includes most of the smoothly rolling and steep hill lands of the county, where drainage is well established. In Cortland County the Lordstown series is represented by two types, the stony silt loam and silt loam.

The Volusia series includes types having brownish gray surface soils and gray and brown mottled, compact subsoils. These soils are level to gently rolling in topography, and are poorly drained. Three types, the stony silt loam, silt loam, and silty clay loam, are mapped in Cortland County.

The soils of the Wooster series are similar to the Lordstown soils in color but differ in being confined to areas of deep till, usually terminal-moraine deposits. The stony silt loam, gravelly silt loam, and silt loam are mapped in the present survey.

The Ontario series includes types having brown, mellow surface soils and yellowish brown, friable subsoils resting upon grayish, calcareous till at a depth of 2 or 3 feet. The topography is undulating to rolling, or kamy to drumloidal, and the natural drainage is variable. Only one type, the gravelly silt loam, is mapped in Cortland County.

The surface soils of the Fox series are brown and the subsoils are light brown to yellowish brown. Beds of gravel carrying a high percentage of limestone material form the substratum at a depth of 2 or 3 feet. The Fox soils are level to gently undulating and naturally well drained. The gravelly silt loam is the only member of this series mapped in Cortland County.

The surface soils of the Chenango series are grayish brown to brown, and the subsoils are yellowish brown, resting upon beds of noncalcareous gravel and sand at a depth of 2 or 3 feet. The topography is level and drainage is good. The stony silt loam, gravelly silt loam, and silt loam are mapped in this county.

The Schoharie series is characterized by brownish gray to brown surface soils and brown to slightly reddish brown subsoils, usually somewhat mottled with gray. The soils of this series are derived from calcareous lake sediments with a peculiar reddish tinge and the subsoils are moderately to rather strongly calcareous. The topography ranges from level to very irregularly rolling, and the drainage is fair to good. The silty clay is the only type of this series mapped in Cortland County.

The Genesee series includes types with brown, mellow surface soils and subsoils and having fair to good drainage, except for occasional overflows. One type, the silt loam, represents the series in Cortland County.

The Holly series includes gray surface soils and gray mottled, compact subsoils. The soils of this series are naturally poorly

drained. Two types, the gravelly silt loam and silty clay loam, are mapped in Cortland County.

Muck consists of decayed vegetable matter mixed with some mineral matter. It has accumulated under poor drainage conditions.

Meadow is a term applied to low-lying areas along streams where the material can not practicably be separated into types, owing to its variability in color and texture.

The following table shows the actual and relative areas of the different types of soil in Cortland County:

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Lordstown silt loam	102,208	31.7	Meadow	3,200	1.0
Lordstown stony silt loam	91,520	28.4	Wooster stony silt loam	2,688	.8
Volusia silt loam	43,072	13.4	Chenango stony silt loam	2,112	.7
Volusia stony silt loam	17,728	5.5	Volusia silty clay loam	1,600	.5
Wooster silt loam	13,248	4.1	Chenango silt loam	1,536	.5
Fox gravelly silt loam	11,520	3.6	Muck	1,024	.3
Wooster gravelly silt loam	9,088	2.8	Schoharie silty clay	640	.2
Chenango gravelly silt loam	5,440	1.7	Holly gravelly silt loam	448	.1
Holly silty clay loam	5,312	1.7			
Genesee silt loam	5,056	1.6	Total	321,920	......
Ontario gravelly silt loam	4,480	1.4			

LORDSTOWN STONY SILT LOAM

The Lordstown stony silt loam consists of a friable, yellowish brown silt loam, underlain at a depth of 5 to 8 inches by brownish yellow silt loam which usually rests upon sandstone and shale bedrock at a depth of 1½ to 3 feet. Numerous angular fragments of shaly sandstone and sandy shale occur on the surface and through the soil section, and in places foreign bowlders are encountered. Along some of the hillsides small areas of poorly drained material (Volusia stony silt loam) are included with this type.

The Lordstown stony silt loam is extensively developed throughout the county, especially in the northern part. It occupies most of the steep slopes and sharp hilltops, as well as many areas of gently rolling topography. Many of the slopes are too steep for profitable cultivation. Drainage is generally thorough, and in places excessive, so that crops often suffer during dry periods.

The type formerly was covered with a heavy stand of sugar maple, chestnut, white pine, hemlock, and wild cherry, most of which has been removed. Some good stands of second-growth timber are found in sections more remote from the railroads. Most of the cleared land is used for pasturage.

Farms on the Lordstown stony silt loam are devoted to dairying and general farming. The principal crops are timothy and clover, other hay crops, oats, buckwheat, ensilage corn, potatoes, and cabbage. Yields are slightly lower than on the Lordstown silt loam.

Land values range from $8 to $35 an acre. Some tracts of this soil are of value only for the pasturage they afford or for the standing timber.

Much of this type should have remained in forest. The pastures can be improved by keeping down the weeds, cutting the brush, and reseeding occasionally.

LORDSTOWN SILT LOAM

The Lordstown silt loam consists of a yellowish brown, mellow silt loam, 6 to 8 inches deep, underlain by a somewhat lighter colored, friable silt loam. The subsoil rests upon the unweathered sandstone and shale at a shallow depth, usually at 2 to 4 feet below the surface, although local areas of deeper material are included. Angular fragments of fine-grained sandstone and sandy shale occur on the surface and throughout the soil section, but seldom in sufficient quantity to interfere with cultivation. Included with this type are many small, poorly drained areas that would have been mapped as the Volusia silt loam had they been large enough.

The Lordstown silt loam is one of the most widely distributed upland types in the county, being most extensive in the central and southern parts. It usually occupies rolling slopes and narrow hilltops. Drainage is thorough, and on some of the shallower areas crops are liable to injury by drought.

Because of its wide distribution, this is one of the most important soil types in the county. Nearly all the original forest, consisting of sugar maple, white pine, chestnut, butternut, beech, and wild cherry, has been removed, and the wooded areas now support a second growth.

Dairying and general farming are the main industries on this type. Nearly every farmer keeps from 5 to 50 or more milch cows, practically all the milk being hauled to a railroad for shipment. The principal crops are hay, corn for ensilage, oats, buckwheat, Irish potatoes, and cabbage.

Mixed timothy and clover yield ordinarily 1 to 1½ tons of hay per acre, although yields of 2 or 3 tons are not uncommon, especially where the soil is in a good state of cultivation. Corn yields from 8 to 12 tons of ensilage per acre. Oats do remarkably well, yielding 35 to 50 bushels per acre. Buckwheat is extensively grown on this soil and yields 25 to 30 bushels. Irish potatoes generally yield 150 to 200 bushels per acre, and in some instances 300 to 325 bushels. Cabbage yields from 8 to 12 tons per acre.

Farmers on this type of soil depend largely upon stable manure for fertilizer, although commercial fertilizers are often used for potatoes and cabbage. Ground limestone is used by an increasing number of farmers. It is applied to plowed land for any crop except potatoes at the rate of 500 to 3,000 pounds per acre, the usual application being 1,000 pounds.

Farms on this soil type range in price from $10 to $75 an acre, according to location with respect to towns and railroads and the condition of the buildings. Land of this type ordinarily sells for about $25 or $30 an acre.

The Lordstown silt loam is deficient in organic matter, which should be added in the form of barnyard or green manure. It also requires lime to correct the acidity. The land should not be mowed for more than three seasons without reseeding. Deeper plowing is necessary on many of the hill farms. Weeds make a remarkable growth on this type, and unless checked soon choke out the better grasses.

VOLUSIA STONY SILT LOAM

The Volusia stony silt loam consists of a brownish gray silt loam, 4 to 8 inches deep, underlain by a gray to grayish yellow silt loam which extends to a depth of 36 inches or more. The subsoil is heavily mottled with brown, yellow, and drab. Both surface soil and subsoil contain a large quantity of angular stones, ranging in diameter from 1 or 2 inches to more than 1 foot, and consisting mainly of sandstone and shale. There is usually encountered in the subsoil at varying depths a rather compact, hard layer which is referred to as hardpan.

The Volusia stony silt loam occurs in widely scattered areas throughout the uplands, being most extensive along the slopes from the hilltops to the valleys and around drainage courses that head in the higher hills. Drainage is poor, seepage waters from the hills frequently flowing through the subsoil the greater part of the year.

This type is largely utilized for pasturage and woodlots. The pastures are usually in fairly good condition. The timber growth consists of beech, maple, elm, and hemlock, with some butternut, basswood, and ash. Very little care is given the woodlots.

Hay crops yield from 1 to 1¼ tons per acre, oats 25 to 40 bushels, and buckwheat 15 to 25 bushels. Neither corn nor potatoes do particularly well upon this type.

The price of land of this type ranges from about $8 to $30 an acre, depending upon drainage, steepness of slope, and accessibility.

Much of this type should remain in forest. The coarser weeds and small brush should be removed from the pastures. On the cultivated fields lime should be used and stable manure applied more frequently.

VOLUSIA SILT LOAM

The surface soil of the Volusia silt loam is a grayish brown or brownish gray silt loam, with an average depth of about 8 inches. In places gray and rusty brown mottlings appear in the lower part. The subsoil consists of a pale yellow to gray silt loam, heavily mottled with gray, drab, orange, and rusty brown, and usually rests upon the bedrock of shale and sandstone at a depth of 3 to 8 feet. Throughout the surface soil and subsoil there are varying quantities of shale and fine-grained sandstone fragments, ranging in size from small chips to slabs 8 or 10 inches long, but in very few places are they sufficiently numerous to interfere materially with cultivation. This type is locally referred to as a hardpan soil, owing to the presence at any depth below 8 inches of a compact layer of partially cemented sand, silt, and rock fragments.

The Volusia silt loam is widely distributed. The largest areas occur in the southern part of the county, especially in the towns of Cincinnatus, Freetown, Virgil, Lapeer, and Marathon. The topography varies from rolling to hilly. Drainage is poor, owing to the hardpan stratum and to the shallow depth at which bedrock is encountered. In many places springs emerge from crevices in the rocks, resulting in semiswampy areas several acres in extent.

Much of the original forest growth, consisting of sugar maple, beech, hemlock, and elm, has been removed. On some of the hills there are now good stands of second-growth maple and beech.

The Volusia silt loam is almost entirely devoted to dairying and general farming. The principal crops are hay, buckwheat, oats, and ensilage corn. The soil is best suited to the production of hay. Mixed clover and timothy yields ordinarily 1 to 1½ tons per acre, and in some cases 2 or 2½ tons, especially where lime has been applied. Buckwheat yields 20 to 30 and oats 30 to 45 bushels per acre. This soil is often too wet to produce good yields of corn, though ordinarily the yields of ensilage range from 6 to 10 tons per acre. Potatoes are grown to only a small extent.

This soil requires more careful handling than most of the other upland types. If plowed too wet it clods and bakes, while during dry periods it must be thoroughly tilled to prevent serious injury to crops by drought. The smaller farms on this type are being combined with larger ones, with the result that many good houses and barns have been abandoned and are fast going to ruin. Agricultural conditions as a whole are unsatisfactory.

Land prices range from $8 to $15 an acre for the poorer tracts and from $20 to $25 an acre for the better tilled farms.

The Volusia silt loam can be improved by artificial drainage, deeper plowing, and the incorporation of organic matter and lime.

More live stock should be kept in order to make available a larger supply of stable manure. Shorter rotations should be used.

VOLUSIA SILTY CLAY LOAM

The surface soil of the Volusia silty clay loam is a grayish brown, compact, heavy silt loam to silty clay loam, 6 to 8 inches deep. The subsoil is a gray, compact silty clay loam, mottled with yellow and brown. Small quantities of shale fragments occur on the surface and throughout the soil section.

The Volusia silty clay loam is not extensively developed in this county. It occurs throughout the uplands in association with other types of this series. The largest areas occur in the towns of Homer and Virgil. The topography is level to gently rolling and drainage is poor.

Fine-rooted crops do best on this soil. Hay yields 1 to 2 tons, oats 25 to 35 bushels, and buckwheat 15 to 20 bushels per acre. Corn, cabbage, and potatoes do not do well.

Agricultural conditions are relatively poor over this soil type. Land prices range from $10 to $15 an acre.

Drainage, deep plowing, and the general use of green and barnyard manures in connection with liberal applications of lime will increase the productiveness of this type of soil.

In the following table are shown the results of the mechanical analyses of samples of the soil and subsoil of the Volusia silty clay loam:

Mechanical analyses of Volusia silty clay loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162313	Soil	0.6	1.2	1.2	4.0	8.7	55.0	29.4
162314	Subsoil	1.8	2.7	1.6	4.6	11.8	57.0	20.2

ONTARIO GRAVELLY SILT LOAM

The surface soil of the Ontario gravelly silt loam is a yellowish brown to brown, mellow silt loam, about 9 inches deep, containing a large proportion of rounded and subangular gravel and small cobbles. The subsoil is a light brown to yellowish brown, gravelly silt loam, little, if any, more compact than the surface soil. The gravel on the surface and throughout the 3-foot section consists largely of sandstones and shale, but from 15 to 50 per cent or more of that in the subsoil consists of limestone. Large, massive bowlders of gneiss, quartzite, and limestone occasionally occur on the surface and throughout the lower part of the soil section.

The Ontario gravelly silt loam occurs in narrow morainic belts along the margins of the larger valleys in the northern part of the county. It is typically developed in the valleys northeast of Cortland and between Homer and Scott. The topography is generally characterized by knolls and ridges, intermingled with kettle holes, though in some places the surface is smooth and only gently sloping. Drainage is thorough and in periods of dry weather some of the more gravelly areas are apt to be droughty.

All but the roughest areas of this type are easily tilled and under cultivation. Hay, corn, oats, potatoes, and cabbage do well. Hay crops yield 1½ to 2 tons, corn for ensilage 10 to 14 tons, oats 30 to 40 bushels, potatoes 100 to 150 bushels, and cabbage 8 to 10 tons per acre. Alfalfa is successfully grown on small patches.

The price of farm land of this type ranges from $20 to $45 an acre, depending upon the location and improvements.

In other parts of New York peas, clover, and alfalfa are successfully grown on this type and they apparently would do well on the same soil in Cortland County.

WOOSTER STONY SILT LOAM

The Wooster stony silt loam consists of a yellowish brown silt loam with an average depth of 6 inches, underlain by a yellowish brown to yellow silt loam which extends to a depth of 36 inches or more. The entire soil section carries sufficient subangular and waterworn fragments of fine-grained sandstone and shale to interfere materially with cultivation. In places foreign bowlders and limestone fragments are present.

The Wooster stony silt loam occupies the roughest parts of a terminal moraine in the valley near South Cortland. The topography is very irregularly morainic and the soil is rather droughty.

Some of this type is under cultivation to general farm crops, and yields are good considering the difficulties in the way of cultivation.

The price of land varies considerably, depending upon the location and improvements.

WOOSTER GRAVELLY SILT LOAM

The surface soil of the Wooster gravelly silt loam consists of a yellowish brown, friable silt loam, about 6 inches deep, containing 15 to 40 per cent of fine-grained sandstone fragments, both angular and waterworn. The subsoil is a slightly lighter colored, gravelly silt loam. In places the soil-forming material is a loam or fine sandy loam, and the deep subsoil and the substratum are very gravelly.

The Wooster gravelly silt loam occurs along the larger valleys throughout the county. Extensive areas are mapped in the towns of

Cortlandville, Harford, Lapeer, Marathon, Willett, Cincinnatus, and Taylor. The topography is rather rough and broken, rendering cultivation somewhat difficult. Drainage is good.

This type is used for general farming. Hay, corn, potatoes, and oats are the principal crops. Apples are grown to some extent and do well. The prices of land range from $30 to $50 an acre.

WOOSTER SILT LOAM

The Wooster silt loam consists of a light brown to yellowish brown, mellow silt loam, underlain by a yellow to yellowish brown, friable silt loam. A few small stones, both angular and waterworn, are scattered over the surface and through the entire soil section. Occasionally a few large foreign bowlders are encountered. In places the lower subsoil approaches a loam in texture, carrying much fine sand and very fine sand, and may grade below into beds of stone, gravel, and sand. While this soil is essentially noncalcareous, it is sometimes impossible to determine the character of the underlying till.

The topography ranges from undulating to hummocky. The rougher areas are difficult to till and are more subject to drought than the smoother areas. The type is confined very largely to the deep till deposits occurring at an intermediate elevation between the level terraces and the high hill lands.

The Wooster silt loam is a strong soil and produces good yields of hay, corn, oats, buckwheat, potatoes, and cabbage. Hay crops yield 1½ to 2 tons, corn 12 to 14 tons of ensilage, oats about 45 bushels, buckwheat 20 to 25 bushels, potatoes 175 to 200 bushels, and cabbage 10 to 12 tons per acre. Apples, cherries, and small fruits do very well.

Land of this type sells for $10 to $60 an acre, depending upon the location, productiveness, and improvements.

Alfalfa succeeds on this type and could well be grown extensively on dairy farms.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Wooster silt loam:

Mechanical analyses of Wooster silt loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162309	Soil	2.8	3.8	1.6	4.2	10.8	63.8	13.2
162310	Subsoil	3.2	3.4	1.3	4.0	11.4	62.6	14.0

FOX GRAVELLY SILT LOAM

The Fox gravelly silt loam consists of a brown to light chocolate brown gravelly silt loam, 8 to 12 inches deep, underlain by a slightly lighter colored gravelly silt loam, which rests upon beds of gravel at a depth of 2 to 3 feet. The gravel on the surface and in the soil and subsoil consists largely of sandstone and shale, but the underlying beds contain a large percentage of limestone. In some places the entire soil section is relatively free from gravel, while in other places small areas approach a gravelly loam in texture.

This type is extensively developed throughout the larger valleys in the northern part of the county. The principal areas occur in the towns of Preble, Scott, Homer, and Cortlandville. The type occupies terraces or benches above normal overflow and has a gently undulating to slightly rolling surface. Its elevation is approximately 1,100 to 1,200 feet above sea level. Owing to the porous substratum, the drainage is excellent.

The Fox gravelly silt loam is more highly developed agriculturally than any other soil type in the county. About 85 or 90 per cent of it is under cultivation. Dairying and general farming are the main industries. Every farmer keeps from 10 to 50 or more cows, the milk being made into butter or hauled to a shipping station. The most important crops are clover and timothy hay, ensilage corn, oats, and cabbage. Alfalfa, potatoes, and peas also are grown. Clover yields from 1¾ to 2½ tons and timothy 1½ to 2 tons of hay per acre. Corn does remarkably well, producing 12 to 17 tons of ensilage per acre. Oats yield 45 to 60 bushels, potatoes 100 to 150 bushels, and cabbage 12 to 15 tons per acre. Alfalfa is not extensively grown, but the acreage is increasing. It yields 2½ to 3 tons of hay in a season. There are numerous small orchards of apples, plums, cherries, and plantings of small fruits.

A common rotation on this type consists of corn one year and potatoes or cabbage the next year, followed by oats sown with clover and timothy, the field remaining in grass from 3 to 5 years. Stable manure is applied to the sod land for corn, and an acreage application of about 250 to 300 pounds of a 3–9–2 fertilizer mixture is made when the corn is planted. For potatoes and cabbage an acreage application of 500 to 1,000 pounds of a 2–8–10 mixture is made. Some farmers obtain good results by top-dressing their mowing land with chemicals. Some form of limestone is commonly used by the more successful farmers.

The price of land of this type ranges from $45 to $150 an acre, depending upon the location and improvements. The average price is about $75 an acre.

CHENANGO STONY SILT LOAM

The Chenango stony silt loam consists of a light brown silt loam, 7 to 10 inches deep, underlain by a light brown to yellowish brown silt loam which rests upon beds of gravel and stone at a depth of 2 to 3 feet. Angular and waterworn fragments of sandstone, ranging in diameter from 2 to 6 inches, are thickly strewn over the surface and scattered throughout the soil section. In places the interstitial material is coarser in texture than usual.

This type occurs on the terraces extending in a westerly direction from Cortland. The topography is nearly level to undulating. Drainage is excessive in dry seasons.

The Chenango stony silt loam can be worked early in the season and is considered a warm soil. The large content of stones, however, interferes with cultivation to some extent. The principal crops are hay, mainly timothy and clover; oats, rye, beans, and cabbage. Both ensilage and sweet corn are grown, the latter being used mainly for canning. All these crops make good yields.

Much of the Chenango stony silt loam is low in organic matter and requires the addition of stable manure, green manures, and lime.

CHENANGO GRAVELLY SILT LOAM

The Chenango gravelly silt loam consists of a light brown to yellowish brown, gravelly silt loam, from 7 to 10 inches deep, underlain by a yellowish brown to yellow, gravelly silt loam, which extends to a depth of 36 inches or more. As a rule the subsoil rests upon stratified deposits of sand and gravel. In places the interstitial material approaches a loam in texture. The gravel consists of fine to relatively large, angular, and waterworn fragments of sandstone and shale.

The Chenango gravelly silt loam is a well-drained terrace soil. It is distributed throughout the county, the largest areas occurring in the Harford Valley. The soil consists largely of noncalcareous sandstone and shale materials and was laid down during glacial times as alluvial plains. Along the Truxton Valley the type consists of material derived from local noncalcareous shale and sandstone, although it is closely associated with limestone material. The topography is undulating.

Most of the type is cleared and under cultivation. Timothy, clover, alfalfa, corn, oats, potatoes, truck crops, and small fruits do well. Mixed timothy and clover yields from 1½ to 2 tons of hay per acre, corn 12 to 14 tons of ensilage, oats 40 to 50 bushels, and potatoes 150 to 175 bushels.

The price of the land depends largely upon the location and the character of the adjacent soil.

CHENANGO SILT LOAM

The Chenango silt loam consists of a light brown silt loam, about 8 inches deep, underlain by a yellowish brown to yellow, friable silt loam, which extends to a depth of 36 inches or more. Both the soil and subsoil may carry a small percentage of small, waterworn gravel. The substratum is usually coarse textured, varying from a loam to a sandy loam.

This type is widely distributed throughout the valleys in relatively small areas. The largest bodies occur near Tripoli, Truxton, Willett, and Cincinnatus. The topography is undulating to nearly level, and typical of the terrace formations. The drainage is thorough.

Most of this type has been cleared and is either under cultivation or utilized for pasturage. Hay, corn, oats, and potatoes are the principal crops.

The price of land of the Chenango silt loam varies according to the location and the character of the adjacent soil types.

GENESEE SILT LOAM

The surface soil of the Genesee silt loam is a brown to light brown, mellow silt loam, about 8 to 10 inches deep. The subsoil is a light brown to yellow, friable silt loam, slightly mottled in the lower part, and extending to a depth of 36 inches or more. This type is quite uniformly free from stones or gravel.

The Genesee silt loam occurs throughout the larger valleys and represents first-bottom sediment derived mainly from sandstones and shales, with some limestone influence. Some of the most typical areas occur along the Tioughnioga River through the towns of Cuyler, Truxton, Homer, Cortlandville, Marathon, and Cincinnatus. Smaller areas occur in some of the other towns.

The topography is gently undulating to level but drainage usually is good except during periods of high water.

Most of this type has been cleared and put under cultivation. Part of it is utilized for pasturage. Hay is the most important crop grown, and yields of 1½ to 2½ tons per acre are obtained. Corn does well in dry seasons, making 10 to 12 tons of ensilage per acre. Potatoes, cabbage, and oats are grown to a small extent.

The price of land of the Genesee silt loam ranges from $25 to $75 an acre, depending upon the location and the adjoining soils.

HOLLY GRAVELLY SILT LOAM

The Holly gravelly silt loam consists of a yellowish gray to gray, gravelly silt loam, 4 to 8 inches deep, underlain by gray and brown mottled, gravelly silt loam. The type contains from 15 to 50 per cent of angular and waterworn fragments of light-colored sandstone

and shale. In color and texture the type shows wide variations, even in small areas.

The Holly gravelly silt loam occurs in small, widely distributed areas throughout the county. It is of alluvial origin and subject to overflow at every period of high water. Drainage is poor.

Very little of this type is under cultivation. It is utilized mainly for pasturage.

HOLLY SILTY CLAY LOAM

The surface soil of the Holly silty clay loam is a gray to brownish gray heavy silt loam, from 4 to 8 inches deep. The subsoil consists of a gray silty clay, mottled yellow and brown, changing at a depth of 15 to 18 inches to a mottled gray or drab clay.

This type varies considerably in both color and texture. In low, slightly depressed areas it may have a 2 or 3 inch covering of peaty or mucky material, or the surface material may be dark gray to black, resembling the Papakating series. In other places the color tends toward a light brown like that of the Genesee silt loam. The texture may vary from a silt loam to clay, while strata of different grades of sand and silt may be encountered in places. Small scattered areas have a silty clay surface soil 3 to 6 inches deep, and a bluish gray mottled stiff silty clay subsoil.

The Holly silty clay loam is not extensively developed in this county. The largest areas occur along the Otselic and Tioughnioga Rivers. It usually occurs in narrow strips along the larger streams. Some of the most important of the silty clay areas occur in the Chenango Valley. The topography is undulating to nearly level.

The type is of alluvial origin and is composed of wash from the sandstone, shale, and limestone soils of the region. It is subject to overflows in seasons of high water, and this, together with seepage and run-off from the uplands, keeps the soil almost continually saturated. Underdrainage is necessary before cultivated crops can be grown.

Much of this type is covered with coarse grass and water-loving plants. It affords some pasturage and, in the drier places, some hay.

In the following table are given the results of mechanical analyses of samples of the soil and subsoil of the Holly silty clay loam:

Mechanical analyses of Holly silty clay loam

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162317	Soil	0.1	0.4	0.6	2.5	15.5	60.4	20.5
162318	Subsoil	.0	.4	1.0	7.7	21.4	51.4	18.0

SCHOHARIE SILTY CLAY

The surface soil of the Schoharie silty clay consists of a brown to grayish brown silty clay, with an average depth of about 9 inches. The subsoil is a heavy, tenacious, light brown to brown silty clay, with occasional mottlings in the lower part. In places fragments of sandstone and limestone are scattered in small quantities over the surface. The subsoil is moderately to highly calcareous.

This type occurs in small areas at the head of Skaneateles Lake in the town of Scott and along the northeastern boundary of the county. The topography varies from nearly level to rolling and hilly. The area in the town of Scott has been badly eroded, and consists of small hills and ridges. Drainage is fair, except in depressed areas.

The Schoharie silty clay is mainly utilized for the production of hay and oats and as pasture land. It is not considered a particularly desirable soil.

The following table gives the results of the mechanical analyses of samples of the soil and subsoil of the Schoharie silty clay:

Mechanical analyses of Schoharie silty clay.

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
162323............	Soil.........	0.4	1.4	1.0	5.7	6.8	59.4	25.2
162324............	Subsoil......	.2	.6	.6	2.2	3.2	34.1	59.1

MUCK.

Muck consists of dark brown to black, finely divided organic matter in an advanced state of decomposition, mixed with some mineral matter, and existing under poor drainage conditions. It ranges in depth from 10 inches to 3 feet or more. In the smaller areas the muck rests upon bluish, claylike material, while in most of the larger areas it is underlain by white marl, consisting of small shells mixed with calcium salts from such plants as chara, and in places has a thickness of 15 to 20 feet. In the areas underlain by marl the type closely resembles the Warners series as mapped in this State. Such areas are situated near Preble, Homer, Labrador Pond, and Cheningo. Smaller areas are encountered throughout the uplands in other parts of the county.

The topography is level or nearly level. In most instances the land is in a swampy condition throughout the year.

The forest growth consists of hemlock, elm, ash, cedar, and swamp maple, with an undergrowth of rushes, ferns, and other aquatic plants. None of the type is under cultivation at the present time.

The price of this land in its present condition ranges from $10 to $30 an acre.

MEADOW

Meadow is a term applied to low, poorly drained areas along the smaller streams where the soil material is so variable in color and texture that it can not practicably be separated into types. In general the surface soil is dark gray to black in color and a silt loam to loam in texture, while the subsoil is gray to light brown in color and a gravelly loam or sandy loam to clay loam in texture. Meadow contains varying quantities of small gravel, as well as stones ranging up to 8 inches in diameter. Large, flat, angular sandstone fragments also are common. Some of this land is utilized for pasturage, to which it is best adapted.

SUMMARY

Cortland County is situated a little south of the center of New York State. It has an area of 503 square miles, or 321,920 acres.

The topography varies from nearly level in the valleys to rolling and hilly in the uplands. Elevations range from approximately 1,000 to 2,000 feet above sea level.

The county is well drained, the drainage for the most part flowing south into Chesapeake Bay. Water-power resources are abundant.

Settlement was begun in 1791, and the county was formed in 1808. The 1910 census reports the population as 29,249, of which 51.5 per cent is classed as rural. Cortland is the county seat and largest town, with a population in 1910 of 11,504. The rural population is gradually decreasing.

Transportation facilities are excellent. The county roads are usually in good condition. All parts of the county have telephones and rural mail-delivery service.

The mean annual temperature is 44.6° F. and the mean annual precipitation 40.86 inches. The rainfall is well distributed. There is a normal growing season of 137 days, the grazing season for cattle lasting three or four weeks longer.

Dairying and general farming are the main agricultural industries. The principal crops are hay, oats, potatoes, buckwheat, and corn. In 1910 there were 2,610 farms in the county, of an average size of 114.8 acres, and 78.3 per cent of the farms were operated by owners. Buildings and farm equipment are in general good throughout the county. The price of farm land in the upland ranges from $10 to $45 an acre, and in the valleys from $35 to $150 an acre, with an average of $75.

The soils of the county have all been derived from glacial débris, composed largely of local sandstone and shale material, with the ad-

mixture of some foreign material brought in from the north by the ice. Nine series, embracing 17 distinct soil types, in addition to Meadow and Muck, are mapped.

The principal upland soils are those of the Lordstown and Volusia series. These are shallow till soils, derived almost entirely from noncalcareous shales and sandstones. They are devoted mainly to dairying and general farming.

The deep till deposits in the valleys give rise to the Wooster series, where the material is almost entirely of sandstone and shale origin, and to the Ontario series, where there is a considerable admixture of limestone material. The soils of these series are best suited to general farming.

The gravelly terrace soils are included in the Fox and Chenango series and the heavier lake deposits in the Schoharie series. The first bottoms are occupied by the Genesee and Holly series and by Meadow. The subsoils of the Fox series are calcareous, while those of the Chenango series are noncalcareous. The Fox gravelly silt loam is the most highly developed soil type in the county.

The Genesee series includes types having brown, mellow surface soils and subsoils and fair to good drainage, except for occasional overflows. Most of the Genesee silt loam is under cultivation, hay being the most important crop. A part of the type is used for pasturage.

The Holly gravelly silt loam and silty clay loam are light-colored, poorly drained soils, used mainly for pasturage.

The Schoharie silty clay, the only type mapped in this series, is unimportant in the agriculture of the county.

Meadow consists of poorly drained material that it is impracticable to separate into types, owing to its variability in color and texture.

Muck consists of decayed vegetable remains mixed with some mineral matter and accumulated under poor drainage conditions.

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Ways of Preserving Beans and Peas

Canned beans or peas

Select young tender beans or peas and prepare them as for cooking. Grade them according to size if there is much variation. Wash them well. Blanch them by means of a wire basket or a piece of cheesecloth for 5 minutes in boiling water. Dip them quickly into cold water. Pack them in clean, tested jars, and add ½ to 1 teaspoonful of salt to each pint jar. Fill the jars with boiling water, adjust the rubbers and the covers, and partly seal the jars. If the hot-water bath is used, sterilize the vegetables for 1 hour on each of three successive days. At the end of the first day's cooking, remove the jars from the water, seal them, and invert them on a cloth to cool at room temperature. On the second and third days, loosen the seal, and repeat the process described for the first day. At the end of the period on the third day, seal the jars. If a steam-pressure canner is used, sterilize the jars for 1 hour under 5 pounds of pressure, or for 40 minutes under 10 pounds of pressure.

Salted string or wax beans

Wash the beans well, and remove the strings. Young beans need not be cut, but well-matured beans should be cut diagonally across the pods. Use stone jars provided with tight-fitting covers. Pack the beans with alternate layers of salt in the proportion of 10 parts of beans to 1 part of salt, by weight. Cover the beans with a cloth, and weight them with an inverted plate on which is placed a heavy stone, scrubbed and scalded. Unless sufficient brine to cover the beans has developed within 36 hours, add weak salt water to the pickle. A 10-per-cent salt solution (about 6 tablespoonfuls of salt to 1 quart of water) may be used instead of the dry salt.

To cook the beans, rinse them off, and soak them overnight in a large quantity of cold water. Simmer them in sufficient water to cover them, until they are tender. Salt pork or bacon or onion and bay leaf may be cooked with the beans for additional flavor.

Dried string or wax beans and dried sugar peas in the pod

All varieties of string and wax beans can be dried. Beans for drying should be in ideal condition for table use. Very young sugar peas may be dried in the pods, since the young pods are edible. When dried, the vegetables should be stored in moisture-proof containers.

Wash the beans, remove the stems, the tips, and the strings. Very young and tender beans may be dried whole. Cut well-matured beans with a vegetable slicer or a sharp knife into pieces from ½ to 1 inch long. If the pods are mature, it is wise to slice thru the beans themselves. Blanch the beans in boiling water for from 6 to 10 minutes, depending on the degree of maturity. One-half teaspoonful of soda may be added to each gallon of boiling water to help set the green color of the beans. Remove the surface moisture, and begin drying the beans at 110° F. Young beans should dry in about 2 hours, and more mature beans in about 3 hours. The beans should be thoroly dry, but before being stored they should be "conditioned" by being placed in boxes and poured from one box into another once a day for 3 or 4 days to mix them thoroly and to give to the whole mass an even degree of moisture. If the beans are found to be too moist, return them to the drying trays for a short time.

Blanch young sugar peas in the pod for 6 minutes, cut them in ¼-inch pieces, and dry them as in the case of string beans.

To prepare the dried beans and peas for the table, soak them overnight, or until they have resumed their natural size, in from 2 to 3 times their quantity of water. Heat them slowly in the same water, and cook them until they are perfectly tender. To the beans add salt pork or bacon, or a slice of onion and a bit of bay leaf to give additional flavor if desired. Do not change the cooking water or throw it away, for it contains valuable food materials. Cook it down and serve it with the beans, or pour it off and save it for use in soups and gravies. Four ounces of dried beans will serve 10 persons.

(17-7-29)

Dried lima beans

Lima beans can be shelled from the pod and dried. If they are gathered while they are young and tender, shell them, wash them, and blanch them for from 5 to 10 minutes, depending on the size and maturity of the beans. Remove the surface moisture, and dry them for from 3 to 3½ hours. Begin drying them at 110° F., and raise the temperature gradually to 145° F.

Dried shelled peas

Method I. Shell young or full-grown peas, blanch them for from 3 to 5 minutes in boiling water, and remove the surplus moisture. Spread the peas in a single layer on trays, and dry them for from 3 to 3½ hours. Begin the drying at 110° F., and raise the temperature very slowly in about 1½ hours to 145° F.

Method II. Shell full-grown peas, pass them thru a meat grinder, spread the pulp on trays, and dry it. Begin the drying at 110° F., and raise the temperature gradually to 145° F. The ground peas dry more quickly than do the whole peas, but they cannot be used in so many ways. They make a good soup, or purée, and may be used alone or in combination with other foods for timbales, croquettes, or loaves.

References

Drying fruits and vegetables in the home. Farmers' bulletin 841. This is obtainable from the Editor and Chief, Division of Publications, U. S. Department of Agriculture, Washington, D. C.

Food preservation: a national challenge. Cornell Reading Course for the Farm Home. Lesson 113.

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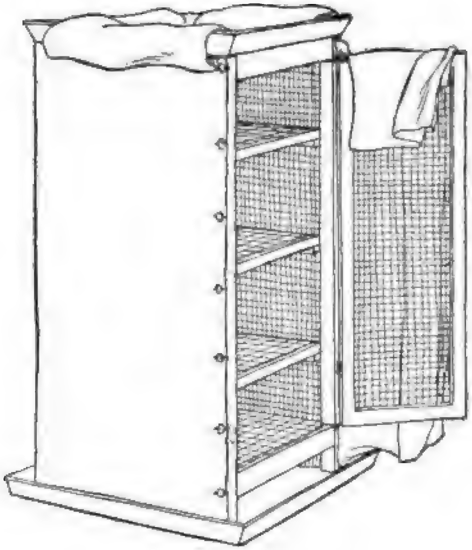
How to Make an Iceless Refrigerator

An iceless refrigerator depends for its efficiency on the cooling effect of evaporating water. An open framework of shelves is surrounded by a cloth kept moist by means of a large pan of water on the top. A good current of air to evaporate the water is essential. The refrigerator will work wherever cloth will dry readily, but it must be kept in a shady place since a low temperature is the main object. A temperature of about 55° F. can be maintained.



AN ICELESS REFRIGERATOR

Make a strong set of shelves open on four sides with a solid top and bottom. Raise it on short legs. Screen this on three sides, and fit a screen door to the fourth side. The efficiency will be greater if the shelves and the botton are made of reinforced screening to allow freer circulation of air.

Cover the four sides entirely with canton flannel, smooth side out, buttoning it closely to the frame. This may be done easily by sewing buttons on tape and tacking this tape firmly around the upper edge of the case on three sides, also down each side of the framework next the door and on the upper and outer edges of the door. Allow a flap of flannel to extend past the outer edge of the door to be buttoned over on the framework. It will be necessary to unbutton and button this flap when opening the case. Make buttonholes in the flannel covering corresponding to the buttons on the case. Around the top of the covering sew four flaps of canton flannel a little narrower than each side of the case and large enough to extend up over the top and dip into the pan of water. These will serve as wicks to keep the entire surface of the flannel moist. If the refrigerator is to be set on the porch, a pan must be placed underneath the refrigerator to catch the water that drips down.

An extra flannel covering should be made for the case so that one may be washed each week.

It is desirable, but not essential, to paint the case with enamel paint. A nonrusting wire must be used for the screening.

Dimensions and materials

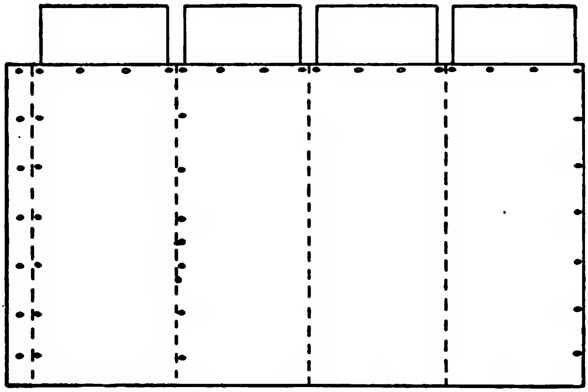
The following dimensions are suggested, and the amount of material required is indicated.

Height: 4 feet, 8 inches.
Base: 24 inches square.
Space between shelves: 11 inches.

(17-7-30)

Materials:

- 3 yards of 24-inch opal zinc screen wire
- 1 pint of flat coat white paint for first coat
- 1 pint of white enamel paint for second coat
- 50 feet of board ¾ x 3 inches for frame and door
- 16 feet of board 1 x 12 inches for 4 shelves
- 4 feet of board 1 x 24 inches for top and bottom
- 46 feet of screen molding
- 2 hinges
- 1 cabinet catch
- 2½ dozen white china buttons
- 10 yards of white cotton tape
- Nails
- Tacks
- 13 yards of 30-inch canton flannel (two covers)



REMOVABLE CANTON FLANNEL COVER FOR THE REFRIGERATOR. THE BUTTONHOLES ARE PLACED TO CORRESPOND WITH THE BUTTONS ON THE FRAMEWORK

(17-7-30)

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Suggestions to Vegetable Growers on Marketing

You have been asked to plant heavily of perishable crops. You have responded loyally, accepting the risk as to adequate returns. Already there is an oversupply of some products, and markets are glutted. There is some loss every year, but this year is no time for waste. You are entitled to a profit for your year's work. The wider use of vegetable food and the canning, evaporating, and storing of surplus products are being urged by many agencies.

There are many things that you can do individually. Most of them you and your neighbors could accomplish much more effectively if united in a local association, even tho it include only a few of your fellow growers. Talk it over, and it may be that the College can help you to form a simple organization.

No one can tell you how to manage your own business. The following points are offered as suggestions. Study them over, and apply what you can. Be governed by the result of careful consideration, not by previous notions. The man with the open mind wins.

Economy. In time of oversupply, it becomes a question whether or not you can afford to harvest a crop. Some growers cease harvesting as soon as the market price goes below the cost of growing and selling. This is wrong. Even tho a part of a crop is sold below cost, the returns from that part help to meet expenses and improve the showing for the whole crop. When, however, the market price falls below the cost of gathering and selling, it is time to cease harvesting. It depends largely on the grower as to when this point is reached. The cost of marketing with various growers varies by from fifty to one hundred per cent.

Vegetable marketing involves the frequent repetition of many small processes, such as peeling onions, bunching beets, sorting potatoes, and trimming celery. A second lost in each operation can easily cost, even in a small business, the time of one man each day. Study all the operations involved, and save wherever possible. Provide facilities for convenience and speed. Do not allow a worker to stoop to the floor if a table can be used. Slow workers cost more than they are worth. You cannot afford to use a worker who requires three motions for an act that should be accomplished in two.

Quality. Even when markets are glutted, good produce seldom remains unsold. It is the quality of the produce when it reaches the consumer that concerns you, for this determines whether more is wanted. Poor produce does not sell freely at any price; it hurts the market for high-grade goods and blocks the outlet for later sales. It is better to sort closely and sell only good produce, if necessary leaving the poorer in the field to make humus.

Business judgment. Never ship produce to a dealer until you learn his standing. Insist on prompt settlement, and watch results closely to be sure that you are getting a square deal. If you would be honestly dealt with, you must be unwaveringly honest yourself. Moreover, the produce trade is too wise to be caught very often. If you are a shipper, it will pay you to visit your markets. Become personally acquainted with the firms with whom you deal. Learn their methods and their problems. Thus will you gain their confidence, and they yours.

Grading and packing. Garden products must be harvested at the proper stage of maturity, handled carefully, graded well, and packed securely and attractively if they are to bring satisfactory returns.

Publicity. Get in touch with your local newspapers, and thru them inform the public as to the maturing of crops. Urge the free use of those of which there is an oversupply.

Canning and drying. Advise your trade as to when prices are most advantageous for canning and drying.

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Advertising. Advertising has helped in other types of business, perhaps it is worth a trial in yours. Use store display cards and newspaper space, but carefully avoid unwise investment. Money must be well directed in advertising, as in agriculture, if it is to bring good results. Advertising will do no good unless combined with high quality, good grading and packing, and good service.

Other markets. If your market is glutted, seek an outlet in other towns and cities, either thru your local produce dealers or directly. The motor truck as well as freight and express, bring many distant markets within reach.

Canning factories. If your neighborhood is growing a large quantity of some one product that is thoroly uniform, find out if a cannery can use it.

Overbuying. Do not let the grocer buy more than he can sell at once. If the product goes down on his hands, he still tries to sell it, and buys no more until it is gone. Thus the outlet is blocked.

Using the College. As marketing problems arise, write fully about them to the College; it may be able to help you. Address Department of Vegetable Gardening, New York State College of Agriculture, Ithaca, New York.

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Ways of Preserving Tomatoes

Canned tomatoes

Select tomatoes that are ripe, but not overripe, and free from blemishes. Do not attempt to handle too many at one time. Carry the canning process thru quickly. Scald them for from ½ to 2 minutes, dip them into cold water, and remove them quickly. With a sharp knife remove the stem core and the skin.

Open-kettle method. Place one layer of the tomatoes in an enamel kettle, and for every quart add 1 teaspoonful of salt and from 1 to 3 teaspoonfuls of sugar. Add no water. Bring the mass to the boiling point, and boil it for from 6 to 10 minutes. Large tomatoes should be turned during the cooking. With a sterilized spoon ladle them into jars that have been sterilized by being boiled for 20 minutes, fill the jars to overflowing. Adjust the rubbers that have been placed in boiling water for 5 minutes, and the covers that have been sterilized with the jars. Seal the jars and invert them to cool.

Cold-pack method. Pack the prepared tomatoes into the jars, pressing them down firmly with a wooden spoon. Fill the jars to within ½ inch of the top with boiling tomato juice. To each quart add 1 teaspoonful of salt and from 1 to 3 teaspoonfuls of sugar. Sterilize the jars in a hot-water bath for 25 minutes.

Tomato purée

2 quarts thick tomato pulp	½ teaspoonful salt
1 medium-sized onion	1 teaspoonful sugar
2 tablespoonfuls chopped sweet red peppers	

Tomato purée may be made from small or broken tomatoes. Cut the tomatoes into fourths, and cook them until the pieces become broken and soft. Press the pulp thru a sieve, discarding only seeds and skins. Add the onion, the chopped peppers, and the seasoning to the strained pulp, and cook the mixture until it is the consistency of catsup. It is necessary to stir it frequently in order to keep it from burning. Pour it into jars, adjust the rubbers and the tops, and sterilize them for twenty minutes in a hot-water bath. Seal them and invert them to cool. The purée may be thinned and used for soup or sauce.

Dried tomato paste

Prepare the tomatoes as for canning. Place them in an enamel kettle, and, without adding any water, boil them until they are tender. Rub them thru a sieve, and boil down the pulp over direct heat until it is so thick that it is difficult to cook without being stirred continually. Then place it over hot water or in a slow oven, where there will be no danger of scorching it but where the moisture will evaporate until the pulp is stiff enough to hold its shape when lifted with a spoon. It may then be placed in hot sterilized jars and sealed; or it may be spread on plates or pans in thin sheets and dried thoroly in a very slow oven, from 130° to 140° F., until it can be cut in squares or rolled in sheets. It should then be stored carefully in moisture-proof containers. This paste may be used for soups, sauces, scalloped dishes, and the like. One teaspoonful of the paste will make one dish of soup.

Chili sauce

12 ripe tomatoes	1 teaspoonful cloves
2 onions	1 teaspoonful cinnamon
1 green pepper	1 tablespoonful salt
¾ cupful brown sugar	½ cupful vinegar

Peel the tomatoes and slice them. Chop the onions and the pepper. Combine the ingredients, and cook the mixture until it is thick. Seal it in scalded bottles or jars.

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Chutney

- 2 dozen ripe tomatoes, medium size, chopped
- 6 onions, medium size, chopped
- 3 red peppers, chopped
- 1 dozen tart apples, chopped
- 1 pound seedless raisins
- 1 cup celery, cut fine
- 2 quarts vinegar
- 3 cupfuls sugar
- Salt

Combine the ingredients, and cook the chutney until it is thick and clear. Pour it into hot sterile jars, and seal them.

Tomato preserves

- 1 peck green tomatoes, chopped
- 6 pounds sugar
- 4 or 6 lemons, sliced thin

Cook the mixture until it is thick and clear. Pour it into scalded jars and seal them.

Spanish pickles

- 1 peck green tomatoes, sliced thin
- 4 onions, sliced thin
- 1 cupful salt
- ½ ounce cloves
- ½ ounce allspice berries
- ½ ounce peppercorns
- ½ cupful brown mustard seed
- 1 pound brown sugar
- 4 green peppers, chopped fine
- Cider vinegar

Sprinkle alternate layers of tomatoes and onions with salt, and let them stand overnight. In the morning drain them, and put them in a preserving kettle. Add the remaining ingredients, using enough vinegar to cover the mixture. Heat it gradually to the boiling point, and boil it for one-half hour. Pour it into scalded jars and seal them.

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Fruit Juices

Remember the fruit juices in your conservation campaign. Properly extracted fruit juices contain much of the sugar and the body-building and body-regulating constituents of the whole fruit, as well as much of its flavor and its pectin (jelly-making substance). Hence fruit juices have a real food value. They also furnish an easy and often inexpensive means of variety in the daily meals, in both warm and cold weather. Fruit drinks, jellied desserts, pudding sauces, ice creams, and ices are easily made from bottled fruit juices, which may often be extracted from parts of the fruits that would otherwise be discarded.

Can fruit juices. Make them into jelly at your leisure, thus saving time and jelly glasses. Extract and strain the fruit juices exactly as you would in making jelly. (Refer to card entitled *Jelly*.) The pulp of most fruits will still yield two extractions of jelly-making juice after the first juice has been strained off. A few fruits will yield five extractions. Return the pulp to the preserving kettle, cover it with cold water, bring it slowly to the boiling point, and simmer it gently for 15 minutes. Strain it thru the jelly bag. Mix the juice from the second and third extractions, boil it down until it gives a pectin test equal to that of the first extraction. To test for pectin, mix thoroly 1 or 2 tablespoonfuls of the hot juice with an equal volume of grain alcohol (90 to 95 per cent), and cool the mixture. If pectin is present, a gelatinous mass that can be gathered on a spoon will appear in the liquid.

Juice suitable for use in fruit beverages or in cooking may frequently be extracted by the same general process from fruit pulp discarded after making jelly or marmalade.

If desired, add 1 cupful of sugar for each 6 cupfuls of fruit juice before boiling the juice. In this case, be sure to note on the label the proportion of sugar used.

Boil the strained juice for 5 minutes, and pour it into jars or glass bottles that have been sterilized by boiling for 20 minutes, filling the jars to overflowing. Seal the jars immediately. Stopper the bottles with corks sterilized and dried for shrinkage, and make an air-tight seal by dipping the cork and the lip of the bottle into hot paraffin.

Fruit juices thus preserved may be used for jelly making at any convenient time, if they contain the necessary pectin and acid. Simply add the amount of sugar still lacking, heat the juice, and boil it until the jelly test may be obtained.

Use fruit juices for drinks, gelatins, and frozen desserts. Juices from pineapples, rhubarb, strawberries, blackberries, raspberries, blueberries, currants, cherries, peaches, plums, apples, pears, quinces, grapes (red, white, and black), are especially good for these purposes.

Extract juice from discarded parts of fruit; from left-over portions of fruit prepared for the table; from skins and pits of peaches; from skins, cores, and seeds of apples; from pulp discarded after making jelly and marmalade; from well-scrubbed skins of oranges and lemons used in making lemonade; from cores, skins, and eyes of well-scrubbed pineapples.

Cover the pulp or parings with cold water, bring the mixture slowly to the boiling point, simmer it until the juice is extracted (15 or 20 minutes), and strain it. Proceed as directed for canning fruit juices.

Cover well-scrubbed skins of pineapples, oranges, and lemons with water, add a little sugar, and let them stan for several hours to draw out the flavoring matter. Use this thin juice immediately tc make fruit drinks.

A rich clear juice may be obtained by allowing well-washed juicy fruits to stand overnight with alternate layers of sugar. If enough sugar is added the next morning (a little more than pound for pound) the strained juice may be sealed, without cooking, in sterilized bottles, stoppered with sterilized corks. This juice, or sirup, is excellent for serving with ice cream or for making fruit ices.

Mix fruit drinks properly. The principal charm of a fruit drink lies in the smooth blending of the various flavors. Unless the fruit juices have been well sweetened before bottling, supply the needed sugar in the form of a sugar sirup; otherwise the juices and the sugar must be mixed and allowed to stand together for several hours before being served. For the sirup, allow 1 cupful of sugar for each cupful of water, and boil them together for about 10 minutes. It saves time and fuel to make a quart or so of this sirup at a time and bottle it boiling hot in sterilized pint jars for subsequent use.

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A small amount of some strongly acid juice should always be added to the fruit drink to give it the proper degree of acidity. The juice of rhubarb or barberries is sufficiently sour to take the place of lemon juice for this purpose. Orange juice may be substituted for lemon juice by adding to it a small quantity of cider vinegar.

Add to the fruit juices enough of the sugar sirup to sweeten them, add enough acid juice to contribute the desired zest, and dilute the whole to taste with shaved ice or with ice water.

Green tea makes a good foundation for a fruit punch.

Make fruit leathers. Concentrate fruit juices by boiling them over direct heat, then by drying them in the top of a double boiler, or in platters or enamel pans set in a moderate oven. The juice is sufficiently concentrated when on cooling it makes a highly glazed tough, dry, leathery jelly. Dry the leather in thin sheets, sprinkle granulated sugar over the surface, and roll the sheets like jelly rolls, then cut them across; or dry the leather in a sheet three-quarters of an inch thick, and cut it in cubes. In either of these forms the leather makes a tempting confection. It should be stored in air-tight containers or in a dry place. The leather may also be cooked with water and made into fruit juice, or it may be added to watery fruits to help supply sugar and pectin for making juices and jellies.

Leathers are also made from unsweetened or slightly sweetened fruit pulp. Peach leather is unsweetened peach marmalade, dried in the oven, sprinkled with sugar, rolled and cut. Strawberry leather is made by crushing sweet, ripe strawberries, and drying them, without cooking, in the oven.

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Save the Fats.—Part I

The war has seriously reduced the world's supply of food fats. Even here in America fats are high in price and scarce.

Every one needs some fat in each day's meals because:

1. Fat is a high energy-producing, or fuel, food. Soldiers and working people especially need generous amounts of fat. An ounce of fat supplies the body with energy to do two and one-fourth times as much muscular work as does an ounce of sugar or of starch.
2. Fat increases the " staying quality " of a meal by increasing the length of time it takes the stomach to digest it. This means that the " hunger pangs" that occur at regular intervals in a completely empty stomach are not felt so early when a meal contains fat.
3. Fat improves the quality of the diet by making possible greater variety in cooking. Frying, roasting, the making of sauces and gravies, and the making of cakes, pastries, and quick breads, all require more or less fat.
4. Certain fats contain substances that are believed to be essential for growth and for life itself. The most important of these fats are milk-fat, egg-yolk fat, cod-liver oil, and beef fat, especially that around the kidneys.

Many are eating more fat than needed. This lavishness may mean robbing our soldiers or some family in Europe. Therefore many of us should reduce our allowance of butter, cream, oil, and cooking fat a little each day.

Some are wasting fat by throwing it away. We must use bits of butter, fragments of suet, or the fat drippings from cooked meats. It is little less than criminal to waste these now. Every bit of fat you save by careful management or by self-denial (1) helps make the world's supply go farther; (2) contributes just that much to some soldier or civilian across the sea, (3) reduces the price of food fats and of soap at home, (4) lessens your own bills.

Insist that all meat trimmings paid for be sent home. Render all meat suets or use them in brown breads or puddings.

Save all drippings obtained from cooking meats. You can find a good use for every kind of fat, no matter what its consistency or flavor.

Render suet. Put the suet thru a food grinder, or chop it fine. If it has a strong odor, soak it awhile in salt water before attempting to render it, and add a pinch of soda to it during the rendering. Render the suet by heating it over hot water or in a pan set in a moderate oven or on the back of the stove until the fat can be pressed from the surrounding tissue, or cracklings. Pour or strain off the clear fat, and squeeze out as much as possible from the cracklings. *Fat keeps better if it has not been heated to too high a temperature. Store the fat in clean tin pails or in crocks, tightly covered, in a cool place.*

Take care of the fat used for deep frying. Avoid burning the fat. Burning is indicated by a deep blue vapor and an acrid odor. Burned fat is injurious to the digestive tract. Keep the fat kettle covered while heating the fat and while it is cooling down. Before setting the fat away, remove burned particles by straining it thru coarse muslin placed over a wire strainer. Keep the fat covered when it is not in use.

Clarify fat. Mix boiling water with the cold fat, boil it vigorously, allow the mixture to cool, and scrape off the impurities that collect on the lower surface of the cake of fat. To remove a slight burnt taste or other objectionable flavors, melt the fat, add thick slices of raw potato, and heat the fat gradually until it ceases to bubble and the potatoes have become brown. A small pinch of baking soda whitens the fat and helps to keep it sweet.

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New York State College of Agriculture at Cornell University, in cooperation with the United States Department of Agriculture

Soften hard fats for use in cooking. Hard fats, such as beef kidney fat and lamb or mutton fat, are unsatisfactory to use in flour mixtures (1) because they must be melted if they are to be mixed easily, and (2) because the product dries out more rapidly than it does if soft fat is used. To soften a hard fat to the proper consistency for use in cooking, mix two parts of hard fat, such as beef or mutton, with one part of softer fat, such as lard, fresh pork drippings, bacon or sausage fat, or cottonseed oil. The mixing may be done while the fat is being rendered or while it is cooling down.

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Save the Fats.—Part II

Substitute cheaper fats for butter in cooking. Butter is not all pure fat. More than one-seventh of its weight is made up of water, curd, and salt. When substituting pure fats, such as beef drippings, lard, chicken fat, or oil, for butter, use about four-fifths as much fat as the recipe calls for, and add extra salt.

The best natural fats to substitute for butter in flour mixtures are rendered chicken fat and beef flank fat. The cod suet from the beef flank is much softer than is beef kidney suet and may be used to good advantage in pastries and cakes. Mutton suet rendered with milk is also an acceptable butter substitute.

Use the cracklings. Grind the cracklings, salt them, and put them in a glass jar. Use them in corncake or suet pudding; or stir them with diced or chopped left-overs of meat into cornmeal mush, mold the mush, and sauté it in savory fat or bacon fat to serve as a meat substitute. Delicately browned cracklings may be eaten with salt like popcorn, or they may be pressed into a loaf, sliced, and served with sliced cold meat.

Do not waste any ham or bacon fat. Use ham or bacon drippings and the clarified fat from the ham kettle for scrambling eggs and making omelets; for frying potatoes eggs, and fish; instead of butter in creole and spanish sauces, in cornbread, molasses cakes, and spice cakes; with baked beans and peas; in bean and pea soups; with spinach and other greens; for making soap.

Utilize mutton fat. Make mutton fat into savory fat, and use it for frying. Mix it with some softer fat, and use it in spice and chocolate cakes. Render it with lard and milk as follows, and use it as a butter substitute with vegetables. Grind two parts of mutton suet with one part of leaf lard, and heat the whole very slowly in a double boiler with whole milk (preferably sour). Use one-half cupful of milk to each pound of mixed suet. Strain the rendered fat thru a cloth, and, when it has set, lift the cake from the milk. Mutton fat thus rendered may be used as a butter substitute in cooking.

Make a palatable sausage substitute. Season the cracklings with salt, pepper, and poultry seasoning, adding stale bread crumbs or left-over cereal and a little egg. Form the mixture into small cakes, and fry it in a little fat.

Disguise the flavor or odor of certain fats. A savory fat that is excellent to use for frying and in gravies may be made by browning with each pound of suet a thick slice of onion, one sour apple, and a scant teaspoonful of ground thyme or mixed herbs, tied in a cloth. If desired, omit the ground herbs, and substitute half a bay leaf and a few allspice berries.

Make soap from fats discarded for food use. A reliable recipe for homemade soap is as follows:

5½ pounds fat	2 tablespoonfuls borax
1 pound lye	½ cupful hot water
6½ cupfuls cold water (rain water if possible)	½ cupful ammonia

Strain and clarify the fat if it has many impurities. Put the lye in a stone or enamel vessel, and add the cold water. Let it stand until it cools. Dissolve the borax in the hot water, and add it to the lye. Melt the fat, warm it slightly, and pour it gradually into the lye, stirring it constantly. Add the ammonia to the mixture before it quite cools. Continue stirring until the soap is as thick as pancake batter. Add a little oil of geranium or other perfume, if desired. Then pour the soap into wooden or paper boxes lined with greased paper. When it is cold,

cut it into cakes. Let it stand a week to ripen, then take it from the boxes and stack it in a warm, dry place. Well-dried soap can be used more economically than freshly made soap. Homemade soft soap saves time in laundering or dishwashing. Directions for making soft soap are found on the lye cans.

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Rejuvenation of Old Worn Meadows and Plowable Run-Out Pastures

On many farms there are old run-out meadows and pastures that can be easily tilled and that should have been broken long ago, sown to cultivated crops for a year or two, and then reseeded with good meadow or pasture mixtures, if the best hay and pasture were to be obtained. Such work has been put off because there seemed to be no way to do it without making a larger investment than seeding justified. The present emergency, together with the high price of wheat, rye, and other small grains, now justifies the breaking of such fields and the establishment of good meadows and pastures in place of the poor ones.

Methods of seeding. Worn meadows and run-out pastures may be seeded with any of the grain crops mentioned, care being taken to plant only such grain crops as soil conditions permit. Fall seeding may be done with wheat on good land and with rye on poor land. Spring seeding may be done on poor land with oats or buckwheat, and on the best land with barley.

When fall seeding is practiced, the grasses in the mixture should be applied at the time of sowing the grain crop, the clovers being applied broadcast in the spring. In spring seeding the whole mixture including both the grasses and the clovers is applied together at the time of sowing the grain crop.

Fertilizers. The matter of proper kinds of fertilizers needs emphasis. Acid phosphate usually improves grain yields markedly and is important in establishing successful grass stands in New York State. Seedings should receive 200 to 300 pounds per acre of acid phosphate or, better yet, a like amount of a fertilizer containing 2 to 4 per cent of ammonia and about 10 per cent of phosphoric acid. In all cases, except on limestone land, lime is necessary to establish good meadows or pastures on worn meadow or run-out pasture lands. In general 1 ton per acre of ground limestone is a satisfactory amount.

A general meadow mixture. For establishing a meadow on land in a good state of cultivation the following mixture per acre is very satisfactory: timothy, 15 pounds; red clover, 5 pounds; alsike clover, 3 pounds.

Another meadow mixture. When the land is not high class, somewhat deficient in lime, and inclined to be wet or to heave in winter, the following mixture per acre is better: timothy, 10 pounds; redtop, 5 pounds; alsike clover, 5 pounds.

A pasture mixture for good land. For pastures on land that is good enough to grow corn satisfactorily, the following mixture per acre is recommended: timothy, 10 pounds; Kentucky bluegrass, 4 pounds; orchard grass, 4 pounds; meadow fescue, 4 pounds; red clover, 5 pounds; alsike clover, 3 pounds; white clover, 2 pounds.

A pasture mixture for poor land. On land that is not good enough to grow corn well the following mixture per acre is better: timothy, 10 pounds; Canada bluegrass, 4 pounds; redtop, 4 pounds; orchard grass, 4 pounds; alsike clover, 4 pounds; white clover, 1 pound.

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Ways of Preserving Peaches

Canned peaches

Scald sound, firm freestone peaches, a small number at a time, in boiling water just long enough to loosen the skins; then dip them quickly in cold water and slip off the skins. The lye dip may be used for removing the skins: Bring 1 gallon of water to the boiling point. Add to it ½ pound of concentrated lye. Lower the fruit into the boiling solution in a wire basket or a thin cloth. Let it remain for from 20 to 30 seconds. Remove the fruit quickly, and immerse it in cold water. Then wash the peeling from the fruit. Cut the peaches in halves, and remove the stones. Have ready a sirup made by boiling sugar and water together until the sugar has dissolved, using ½ to ¾ cupful of sugar to each cupful of water. Allow about 1 cupful of water for each quart jar of peaches. Put in 1 cracked peach pit for every quart of sirup.

Cold-pack method. Pack the peaches in overlapping layers with the rounded side uppermost and the blossom end facing the glass. Fill each jar with hot sirup and adjust the rubber, the cover, and the upper clamp, thus partly sealing the jar. Place the jars on a rack in a hot-water bath that covers the tops to a depth of 1 inch. Bring the water to the boiling point, and boil pint jars for 16 minutes, quart jars for 20 minutes. Remove the jars, seal them, and invert them to cool.

Open-kettle method. Cook the peaches in the sirup until they are tender; then with a sterilized spoon slip them carefully into a jar that has been sterilized by being boiled for 20 minutes, and fill the jar to overflowing with sirup. Adjust the rubber, which has been in boiling water for 5 minutes, and the cover, which has been sterilized with the jar. Seal the jars immediately, and invert them to cool.

Baked peaches

Baked peaches may be canned, or served as soon as they are removed from the oven and cooled. Dip the peaches in boiling water and then in cold water, and slip off the skins. Cut them in halves, and remove the stones. Place them in a baking dish or a granite pan. Fill each cavity with 1 teaspoonful of sugar, ¼ teaspoonful of butter, a few drops of lemon juice, and a sprinkle of nutmeg. Bake the peaches in a moderate oven until they are tender, from 30 to 45 minutes. If they are to be canned, pack them boiling hot into sterilized jars with a sterilized spoon, adjust the sterilized rubbers, and pour over the fruit any sirup that has formed in the pan. Fill each jar to overflowing with boiling sirup (½ cupful sugar to 1 cupful water). Adjust the sterilized covers, and seal the jars.

Pickled peaches

4 quarts peaches	2 cupfuls vinegar	½ ounce whole cloves
2 pounds brown sugar	1 ounce stick cinnamon	

Boil the sugar, the vinegar, and the cinnamon for 20 minutes. Dip the peaches quickly in hot water; then rub off the fuzz with a cloth. Place a few of the peaches at a time in the sirup, and cook them until they are tender. Pack them into sterilized jars. Adjust the sterilized rubbers, and fill each jar to overflowing with the hot sirup. Adjust the sterilized covers, and seal the jars immediately.

Peach butter

Peel and stone the peaches as for baked peaches. Cook them in a very small amount of water until they are reduced to a pulp. Add ¾ as much sugar as pulp, and cook the mixture until it is thick and clear, stirring it frequently. Pour it into sterilized jars, and seal them.

Peach and apple jelly

Wash the peaches thoroly, remove the stones, and cut them in pieces. Add a very little water, and cook the peaches until they are very soft. Strain the juice thru a jelly bag. To the peach juice add ¼ as much tart apple juice. Boil the mixture for 5 minutes, add ¾ as much sugar, and continue the boiling until the jelly test is observed. Turn the jelly into scalded glasses, and when it is cool seal them with paraffin.

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The apple juice contributes the needed acid and pectin to the combination, and gives a better texture to the jelly without perceptibly altering the flavor.

The pulp left in the bag after straining off the juice can be used for marmalade.

Peach marmalade

To the peach pulp left from making jelly, add ⅔ as much sugar by weight, and cook the mixture until it is thick and clear. Turn it into sterilized jars, and seal them. If a more acid flavor is desired, add ½ as much tart apple pulp.

Peach paste

Make a peach marmalade, using from ⅙ to ¼ as much sugar as pulp. Cook the paste down as much as is possible without danger of burning; then spread it on platters or on greased paper, and complete the drying in a cool oven or in any homemade or commercial drier. The paste is done when it can be lifted in a thin layer. Store it in moisture-proof containers.

Peach and apple conserve

Use equal parts of peaches and apples, diced. Add ¾ as much sugar as fruit. Cook the mixture slowly, until it is thick and clear. Seal it in sterilized jars. If the apples are a good color, do not peel them. Equal parts of rhubarb, peaches, and apples may be used.

Dried peaches

Peaches are better if they are peeled before drying.

Remove the skins as directed for canned peaches. Cut the peaches in halves or in smaller pieces, and spread them on trays in a drier or on platters in a cool oven. If drying peaches in halves, lay the cut side uppermost. Dry the peaches for from 4 to 6 hours, or even longer, until they are tough and somewhat leathery. Start the drying at about 110° F., and raise the temperature gradually to about 150° F. as the outside of the peach dries.

After drying, let the peaches stand for a few hours to absorb moisture from the air; then pack them in moisture-proof containers.

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Making Kraut for Home Use or Market

Gardeners or farmers should plan to make surplus cabbage into kraut for home use or market. Well-cured kraut is very palatable and may be sold in bulk, locally, or packed in hermetically sealed cans to supply a special trade.

Kraut is cured in straight-sided wooden casks or earthenware jars. The latter are the more desirable, since tainted flavors often result from casks that are not made of cypress or white pine. Concrete stationary tanks are used in factories where kraut is made on a commercial scale. The size of the container for home use will depend on the amount of cabbage available. Eight or ten gallons of kraut is sufficient for the average family. A jar of this size will hold from forty to fifty heads of cabbage well shredded and packed.

Cabbage that is not desired for storing should be chosen. Each head is cut from its stalk just above the loose outer leaves and taken to a convenient workroom or sheltered place. The loose green leaves are removed, and each head is cut in halves lengthwise. Portions of partly bursted heads may be used if green edges are trimmed along the openings. Cores are taken out by means of a sharp knife.

The cabbage is next cut into long fine shreds. If only a little kraut is made, a long sharp knife will answer for this operation; otherwise a cutting board is needed. A two- or three-knifed board is desirable and should be fitted with a sliding box arrangement for containing the cabbage, thus reducing the danger of slicing the operator's fingers. Such boards cost from $1.50 to $2.75. Hand-power shredders of several tons daily capacity may be desirable when making kraut in large quantities. A shredder of this type consists of a rotary tub operated by a crank, over three or more stationary semicircular knives.

A layer of shredded cabbage 4 to 6 inches deep is placed in the bottom of the jar. Dairy salt or the best grade of table salt is sprinkled over the surface at the rate of 1 pound of salt to 40 pounds of cabbage. The layer added is tamped with a hardwood weight similar to a large wooden potato masher. Other layers are added, salted, and tamped until the jar is heaping full. If desired, a few juniper berries may be added to give a distinct flavor. A quantity of loose cabbage leaves, thoroly rinsed, is laid over the kraut, and a porcelain plate or perforated wooden cover is fitted to the inside of the jar. A clean stone is used to weight the lid down during the curing process. If the tamping has been thoroly done, the contents of the jar, other than the stone weight, will be covered with liquid. Protection from dust and flies may be provided by tying several layers of cheesecloth securely over the jar.

Kraut made early in the season cures in sixteen to twenty days. Later in the season, the curing process continues for three or four weeks. Since a temperature of 59° to 64° F. is most favorable to the bacteriological action that effects the curing, it is best to place the jar in a cellar or a cave. Several days should be allowed after the kraut is cured before it is used. The curing process is completed when bubbles cease to rise at the edge of the jar. This can be determined by removing the cloth cover occasionally.

The cabbage leaves, with possibly a thin layer of discolored kraut, will need to be discarded from the top of the jar. Properly cured kraut is of a rich light yellow color, and may be taken from the jar as needed for table use or market purposes if sufficient liquor is left to keep the remaining quantity covered continually.

A common practice in many households is to pack the product in glass jars or sealed tin cans. This does away with the trouble of opening the jar during the winter. Practically all kraut for commercial use is packed by manufacturers or by canning factories in hermetically sealed containers. Cans are filled securely, and a little liquor or water is added. The contents of each can when turned out usually stands up alone in a solid mass. Lacquered cans are preferable to those of hole and cap type.

Local markets usually buy and sell kraut in bulk. This practice is not so convenient and is likely to be less sanitary than that of handling the product in hermetically sealed cans.

(17-3-31)

The average price paid by local markets for kraut in bulk ranges from 25 to 60 cents per gallon, according to demand. Canned kraut retails for 12 to 20 cents per can. Hotels and restaurants furnish a ready market for bulk or canned kraut of first-class quality during the winter season.

Ways of using kraut

Kraut and pork chops. Broil the pork chops in a pan. Remove them and place them in a warming oven. Add to the fat in the pan, 1 cupful of bread crumbs and 2 cupfuls or more of kraut. When the mixture is thoroly heated, shape it into a loaf. Place it on the platter, and arrange the chops around it. Garnish the dish with parsley.

Kraut and bacon. Broil as many slices of bacon as desired. Remove the bacon, and brown in the fat 1 small onion, sliced thin, and 1 cupful of diced tart apple. Then add about 1 pint of kraut and heat it thoroly.

Kraut with spareribs or frankfurters. Kraut is good served with either spareribs or frankfurters, pan-broiled. The kraut is heated in the fat that cooks the meat.

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Fall Spraying for Peach Leaf Curl

Where the curl fungus winters. The spores of the curl fungus pass the winter among the hairs on the bud scales. Practically every bud is infested by the spores. So long as the buds remain dormant the spores are inactive, but weather favorable to swelling of the buds also starts germination and growth of the spores. Very shortly, if the weather is rainy, the fungus enters the young leaf and infection occurs. Spraying is then too late. In order to be absolutely safe the grower must apply the fungicide before there is the slightest growth or swelling of the buds. Since every bud is liable to be infested with the fungus, satisfactory results from spraying cannot be expected unless every bud is coated.

Objections to spring spraying. In times past the advice has been to spray in the spring just before the buds start to swell. But experience has demonstrated several practical difficulties in making the application at this time of year. Spraying in the spring is often done too late. This is because the grower is unable to get on the ground at the right time. The result in many cases is that the spraying is done after infection has occurred. Observations made in the spring of 1917 show that more than half of the spring-sprayed commercial peach orchards examined in western New York were sprayed too late.

Fall spraying best. It appears then that spring spraying for curl not only is unsafe from a practical standpoint but often fails absolutely.

As already stated the spray must be applied while the buds are entirely dormant. Since effective spring spraying is often impossible, and since the operation cannot be performed in severe winter weather, the question of the efficacy of fall spraying has arisen. Recent experiments, carefully controlled, show that fall spraying is a success. In orchards where thorough fall spraying had been done in 1916 there was very little curl the following spring; in several orchards practically no trace of the disease could be found. Unsprayed trees were seriously diseased. Practically all peach growers who made the fall spray in 1916, of whom there are several hundred, expect to continue the practice in the future. It is believed that the operation under the favorable conditions of the fall will prove to be cheaper on account of the less time necessary for covering an orchard. The application may be made at any time after the leaves drop in the autumn. Fall-sprayed orchards will require no spring application for curl.

(17-9-30)

Spray to use. Lime-sulfur, concentrated, 32° Baumé diluted 1–15, will control curl. If the dilution of the concentrated solution is made 1–8, it will control San José scale at the same time. Bordeaux mixture (3 pounds copper sulfate, 3 pounds lime, 50 gallons water) or copper sulfate (2 pounds to 50 gallons water) is also efficient for curl, but does not control scale.

For further information on this subject, address **The Department of Plant Pathology, New York State College of Agriculture, Ithaca, New York**

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A Dozen Kinds of Bread

With the war emergency likely to drain our supply of accustomed foods, the housewife has to be quick to meet new situations. Especially is there need to know how to make several different kinds of bread in order to use whatever grain happens to be abundant. The recipes given here offer an opportunity to save the scarce product. More than that, they add variety to our ordinary limited bread ration.

White bread (2 loaves)

2 tablespoons sugar — brown or granulated — honey, molasses, or corn sirup. (The sugar may be omitted.)
2 tablespoons any kind of shortening. (The shortening may be omitted.)
2½ teaspoons salt
2½ cups liquid — water, scalded milk, rice water, or whey
½ to 2 cakes dry or compressed yeast, or ⅔ to 2 cups potato yeast
6 to 8 cups white bread flour

The amount of flour varies slightly. A smaller quantity of good bread flour than of poor, is required. If the flour is damp, more must be used than if it is dry. The shortening and the sugar may be omitted. If the bread is to be made in 8 hours, only ½ cake of dry or compressed yeast or ⅔ cup of liquid yeast need be used. If the bread is to be made in 4 hours or less, 2 cakes of dry or compressed yeast or 2 cups of liquid yeast are needed.

General directions for mixing and baking bread

1. Add the hot scalded milk or other liquid to the sugar, the salt, and the shortening.
2. When this is lukewarm, add the yeast, which has been softened in a small amount of lukewarm water. This water is included in the amount of liquid given in the recipe.
3. Add one-half the amount of flour called for in the recipe. Beat the mixture well. Add the rest of the flour slowly until the dough is stiff enough to knead.
4. Knead the dough, using as little flour as possible on the board, and adding only enough flour to keep the dough from sticking. Continue kneading until the dough is smooth and will form a ball that does not flatten out when it stands on the board. When the dough does not stick to the board, on which there is no flour, it has been sufficiently kneaded.
5. Moisten the top of the dough with water or fat to prevent a crust forming on it. Cover the dough with a towel, and set it aside to rise in a warm place at a temperature of from 85° to 90° F.
6. When the dough has risen until it is twice its original size, work it down by folding the sides under four times.
7. Cover the dough again, and allow it to rise until it has increased its size by one-half.
8. Shape the dough into loaves, and place them in greased pans. The pans should be about half full.
9. Allow the loaves to rise until they are double in bulk. The dough will then begin to follow the shape of the pans.
10. Bake the loaves for from 50 to 60 minutes in a moderate oven at a temperature of from 380° to 400° F. The bread should begin to brown at the end of 15 minutes.
11. Remove the bread from the pans at once, and place the loaves where they will cool quickly. Do not cover the bread while it is hot.

Variations

For variation in kind of bread, use the recipes and directions for making white bread, substituting, according to the following suggestions, other flour or cereals for part of the white flour. The substitutes may be used in larger proportions than are here indicated, but the loaves will not be so light or so similar to white bread.

Entire wheat bread. 6 cups entire wheat flour, 2 cups white bread flour. Follow the general directions.

(17-10-40)

Graham bread. 6 cups graham flour, 2 cups white bread flour. Follow the general directions.

Rolled oats bread (not kneaded). 1½ cups rolled oats, 5¾ cups white bread flour. Pour boiling milk or other liquid over the oats, the salt, and the sugar. When the mixture is lukewarm, add the yeast. Add the flour, and beat the dough well. When it has doubled in bulk, beat it well. Turn it into greased bread tins. When it has doubled in bulk, bake it for 1 hour. Generally molasses or brown sugar is used instead of granulated sugar.

Rolled oats bread (kneaded). 2 cups rolled oats, 6 cups white bread flour. Add the boiling liquid to the rolled oats, the salt, the sugar, and the shortening; when the mixture is lukewarm, add the yeast. Then add the flour, knead the dough, and proceed according to the general directions.

Rice bread. 2 cups cooked rice, rice water for liquid, 3 cups graham flour, 5¾ cups white bread flour. Boil ½ cup of rice in 2 quarts of unsalted water for from 15 to 20 minutes. Drain the rice, and dry it over the rice water for a few minutes. Follow the general directions.

Wheat bread (bread crumbs). 2 cups bread crumbs, 5½ cups white bread flour. Add the boiling liquid to the bread crumbs, sugar, shortening, and salt. When the mixture is lukewarm, follow the general directions.

Wheat bread (home-ground wheat). 4 cups home-ground wheat, 4 to 4½ cups white bread flour. Follow the general directions.

Potato flour bread. 2 cups potato flour, 5½ cups white bread flour. Follow the general directions.

Rye bread. 3 cups rye flour, 4½ cups white bread flour. Follow the general directions. Since the dough is soft and sticky, it is difficult to knead; but do not let this tempt you to add more white flour.

Barley bread. 4¼ cups home-ground barley meal, 4½ cups white bread flour. Follow the general directions. One cup of barley makes 1¾ cups of barley meal.

Corn bread. 2 cups corn flour, 7 cups white bread flour. Follow the general directions.

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